NO-FAIL MITERS

SIMPLE TABLE SAW TECHNIQUE

# ShopNotes®

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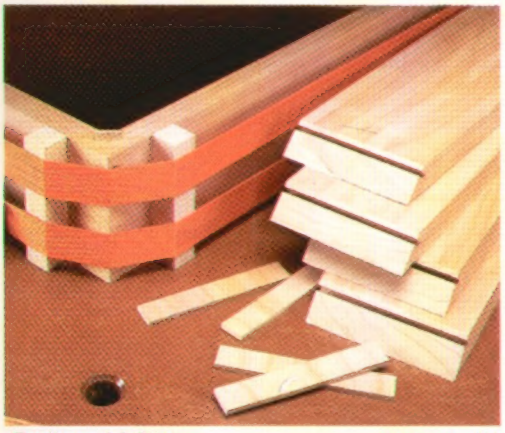

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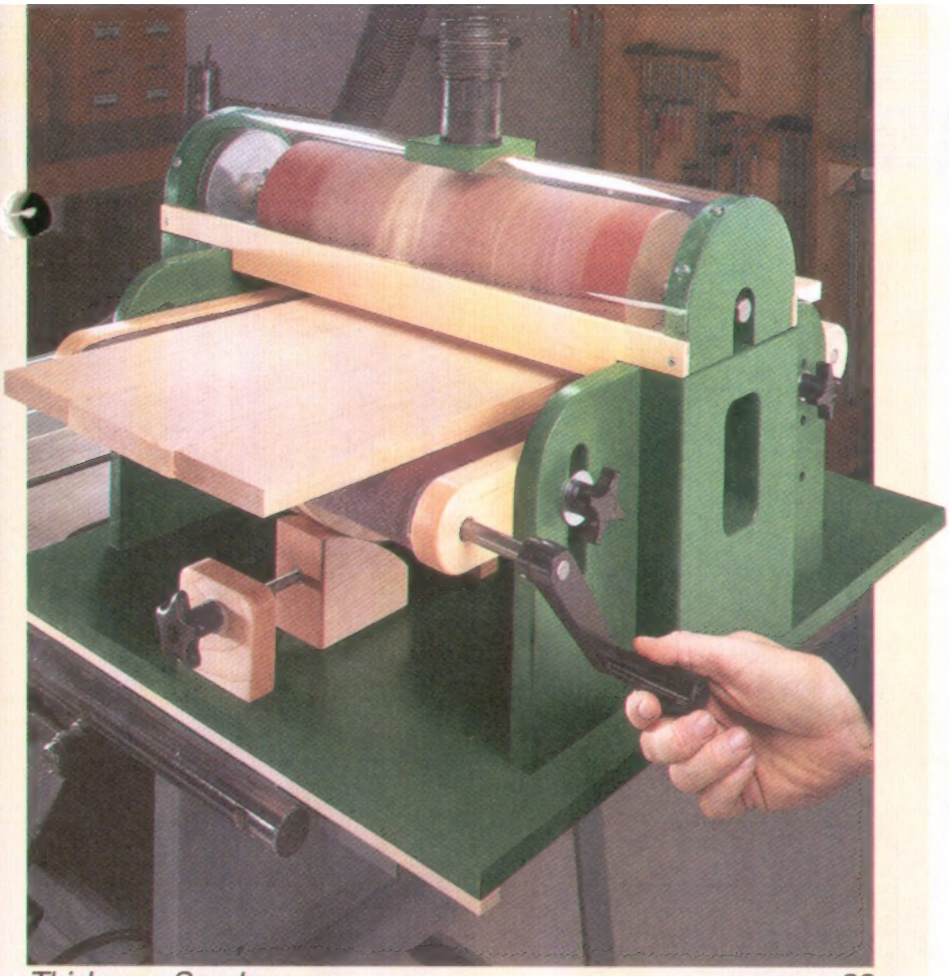

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# Cutoffs

Most woodworkers I know really don't enjoy doing any kind of sanding, (myself included). Especially when it come to leveling out large panels. Let's face it, it can be time-consuming, messy, and a bit tedious. That's why I've always been envious of woodworking shops that have a thickness sander.

The idea behind a thickness sander (also called a drum sander) is pretty simple. Sandpaper is wrapped around a large drum, and as the drum spins the workpiece passes under it and is sanded smooth. The result is a perfectly flat panel with a minimum of fuss. Of course, all this convenience comes at a rather hefty price. A sander that can handle a 16"-wide panel can cost up to seven hundred dollars. So I didn't have any immediate plans for putting a thickness sander in my shop — until now.

In this issue, we're featuring a thickness sander you can build yourself for less than two hundred dollars in materials. You don't even need to purchase a motor — the drum is powered by your table saw. Not only does this help keep the cost down, but it makes the sander easier to store when it's not being used. For the complete story, check out the article on page 28.

**New Face.** I'm happy to announce, Dennis Perkins has joined us as an assistant editor. Dennis is an accomplished woodworker with a shop full of very nice tools. (He even has his own thickness sander.)

Terry

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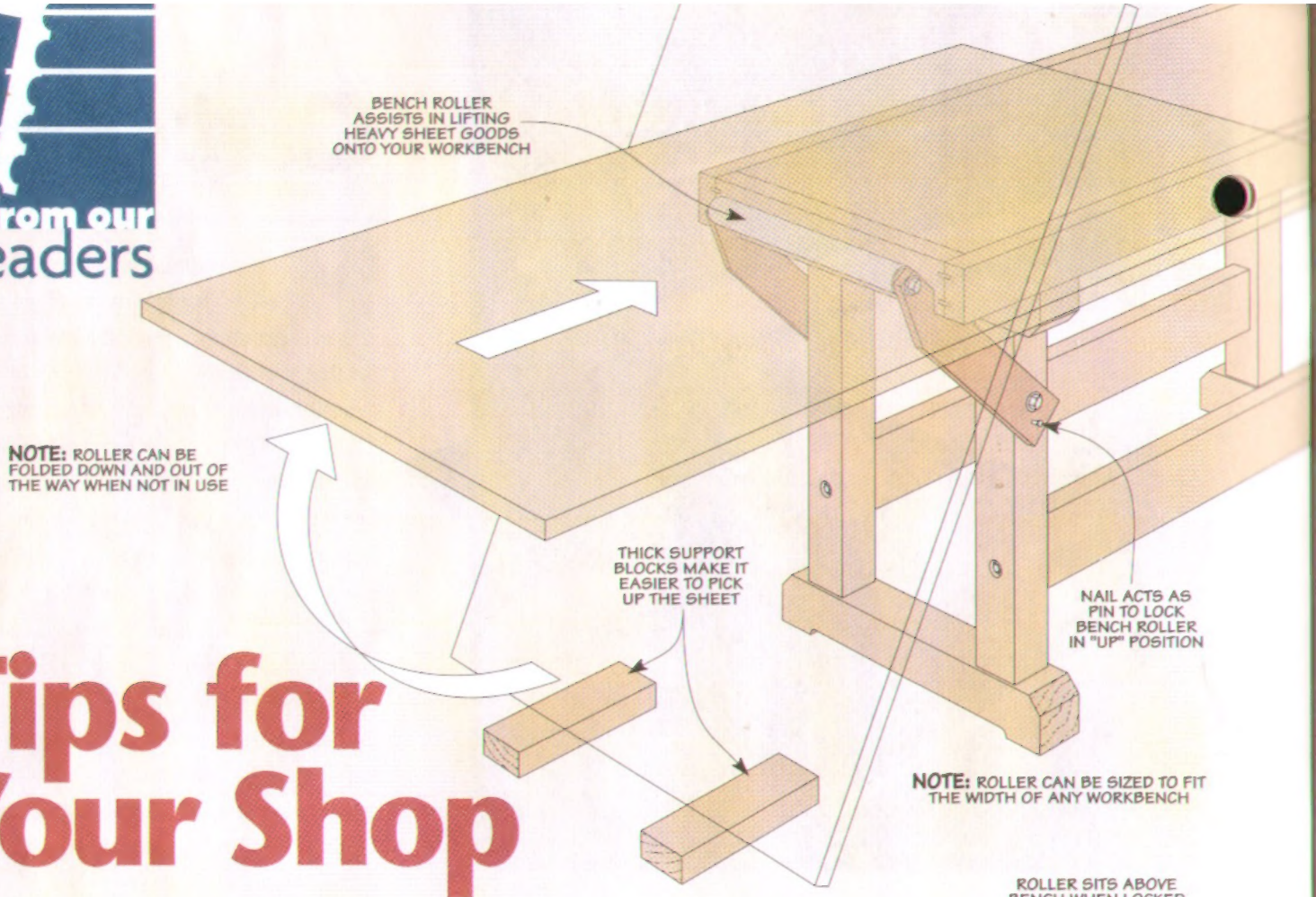
This symbol lets you know there's more information available online at **www.ShopNotes.com**

from our Readers

# Tips for Your Shop




## Sheet Goods Bench Roller

Handling oversized material in the shop is always a challenge. It's often difficult to get a large sheet in position on my table saw. I find it easier if I can get the workpiece on my workbench first and then slide it over onto the table saw. The hardest part is lifting it up onto the top of the workbench.

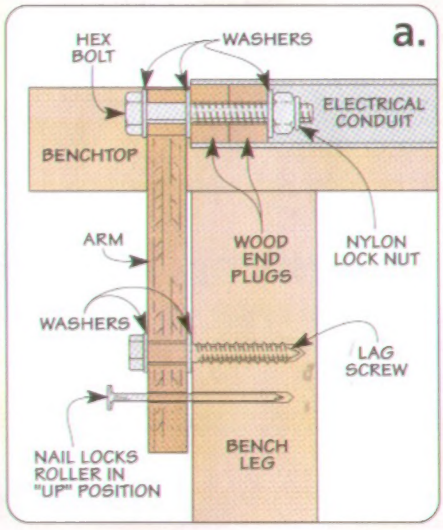
To help me lift the sheet, I built a simple roller that attaches to the end of my workbench. This roller lets me place the material next to the bench and then easily tilt it up onto the top of the bench.

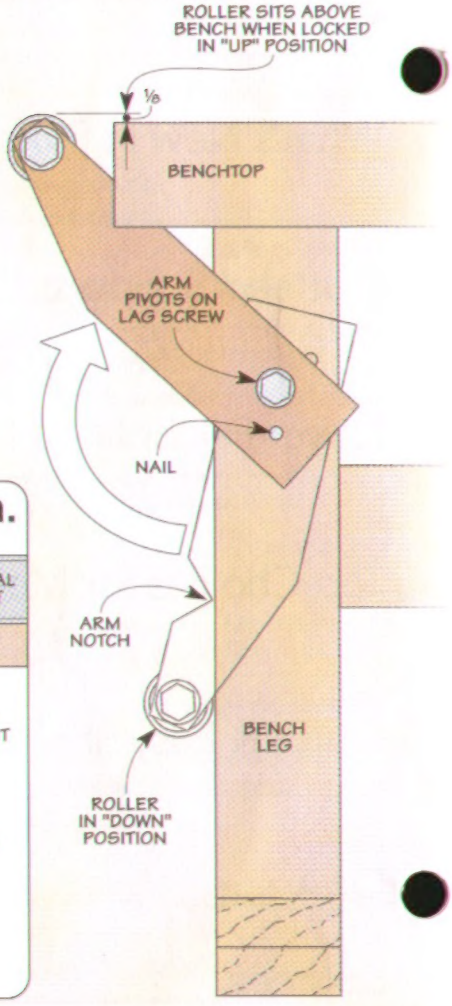
The roller is a length of 1½" electrical conduit. Two hex bolts connect wood end plugs to a pair of side arms that attach to the bench (see detail 'a' at right). I used epoxy to secure the roller to the wood disc end plugs after assembling the arm.

Each arm is notched so the roller can be locked in position slightly above the bench top (see drawing at right). A nail acts as a pin to lock each arm in place (see detail 'a').

Using the bench roller is easy. Just insert the pin to lock the roller in the up position. Next, set the sheet on 2x4's so it's easy to get a hold of. Then, as you lift the sheet, the roller helps slide it up on the bench. Finally, pull the pin and fold the roller down out of the way.

*Leo Schlecht*
*Chicago, Illinois*



# Foam Sheet Dust Prevention

I'm always trying to improve the dust collection in my shop. And while the dust port on my table saw does a good job, I find that a lot of the suction is lost through the large slot where the shaft for the blade height adjustment wheel and indicator is located.

To solve this problem, I attached a closed-cell, adhesive-backed foam sheet I found at a local craft store to the inside of the cabinet. The foam can be easily cut, so you can quickly make a slot to provide clearance for the shaft (photo below).

Now whenever I use my table saw, the dust no longer escapes out of the slot on the front of the cabinet. And more importantly, the foam greatly improves the suction and efficiency of my dust collection system.

*Chris Adams*
*Madison, Alabama*

## Submit Your Tips

If you have an original shop tip, we would like to hear from you and consider publishing your tip in one or more of our publications. Just write down your tip and mail it to: *ShopNotes,* Tips for Your Shop, 2200 Grand Avenue, Des Moines, Iowa 50312. Please include your name, address, and daytime phone number (in case we have any questions). If you would like, you can FAX it to us at 515-282-6741 or simply send us an email message at: shopnotes@shopnotes.com. We will pay up to $200 if we publish your tip.

## The Winner!

Congratulations to Leo Schlecht of Chicago, Illinois. His tip on making a sheet goods bench roller was selected as winner of the *Porter-Cable* router just like the one shown at the right. His bench roller helps him lift sheet goods onto the top of the workbench and folds down after use.

To find out how you could win a *Porter-Cable* router check out the information above. Your tip just might be a winner.

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# Small Parts Clamp

I build a lot of small boxes to give as gifts. This involves gluing and clamping small parts together. But it's always a challenge to align large clamps to hold the sides of the box in place as the glue dries. To make this job easier, I built the small parts clamp you see in the photo above. It's simple to use and adjusts to accommodate different sizes.

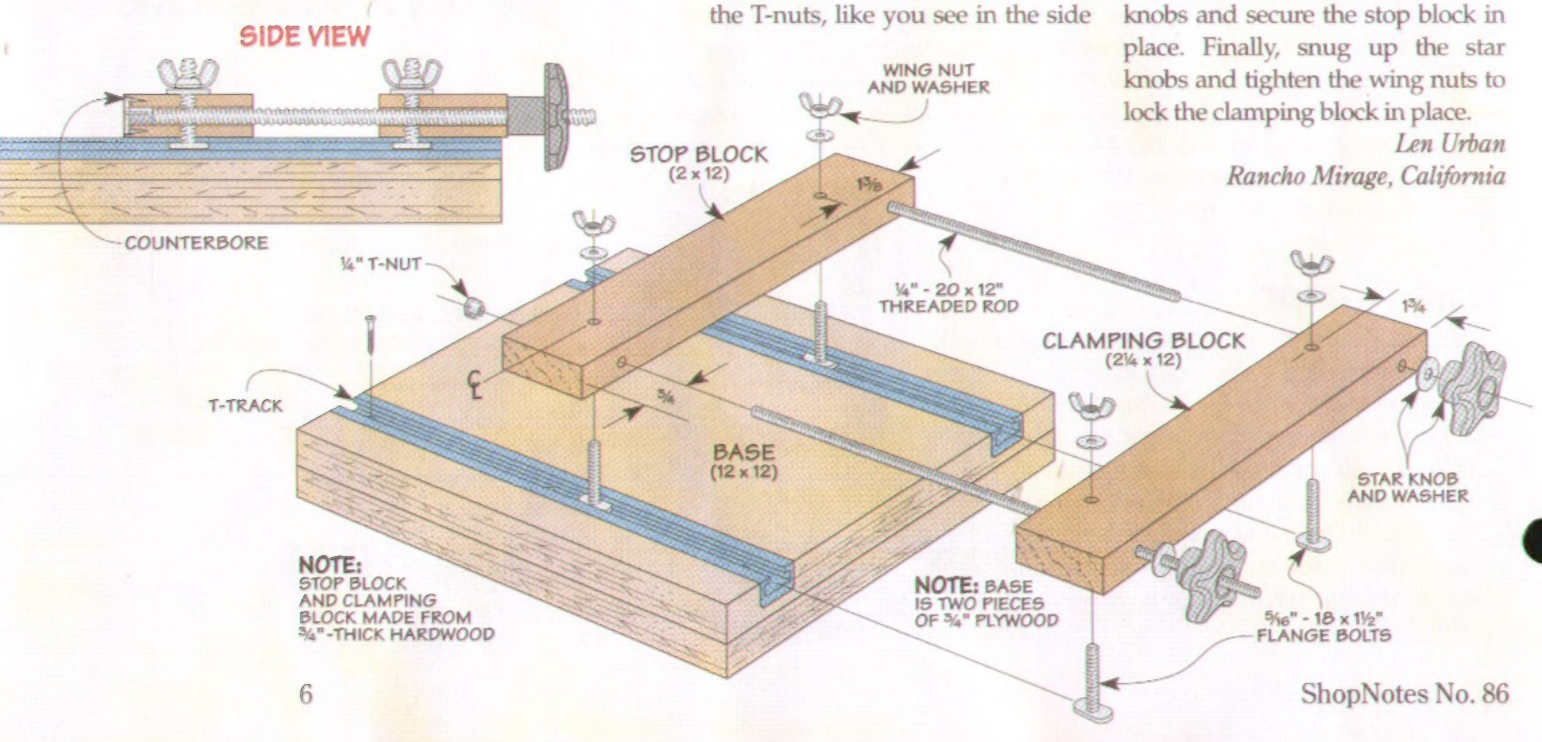
The base is two pieces of ¾" plywood glued together and trimmed to size. I routed two slots in the base and installed a pair of T-tracks as shown in the drawing below.

Next, you'll need to cut two pieces of hardwood to size for the stop block and clamping block. And drill holes in the blocks as shown in the illustration below.

Now, you can place a T-nut in each hole at the back edge of the stop block, slide a threaded rod through the holes in both of the blocks and then screw them into the T-nuts, like you see in the side view at left. A little epoxy at the end of the rod will keep it from turning. Next, slide the four flange bolts in the T-track, slip the blocks over the bolts and add the washers and wing nuts. Finally, add the washers and thread the knobs on the rod.

To use the clamp, loosen the wing nuts and place the parts to be clamped between the blocks. Position the front of the clamping block to extend slightly beyond the edge of the base so you can turn the knobs and secure the stop block in place. Finally, snug up the star knobs and tighten the wing nuts to lock the clamping block in place.

*Len Urban*
*Rancho Mirage, California*



# Hammer Rack

Whenever I work in the shop, I always seem to be looking for my hammer. It's usually in a different place each time I need it. So I built a designated storage space for each hammer. This way, I can quickly find them or know when one of the hammers is missing.

The hammer rack is quick, easy, and inexpensive to build. First, cut a strip of ¾" plywood 3½" wide. Then all you need to do is lay each of your hammers on the plywood strip and simply trace the shape of the hammer head onto the plywood with a pencil.

Finally, a quick trip to the band saw is all it takes to cut out the opening to fit the shape of each hammer.

Now, all that's left is to mount the rack to the wall with a few screws, and hang each hammer in its slot.

*Dennis Augustine*
*Salina, Kansas*

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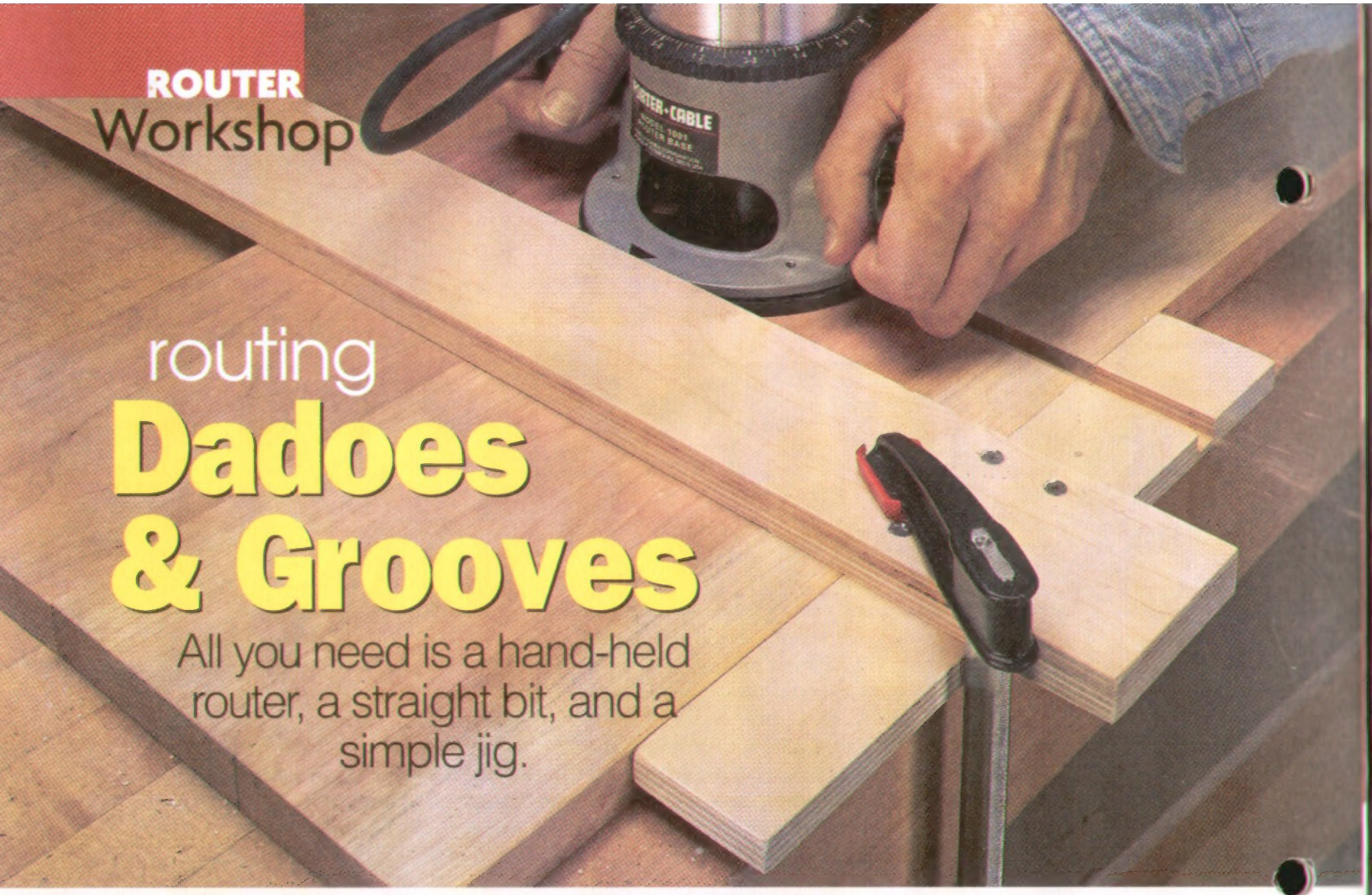
## Quick Tips

◄ *Grant Johnson of Rhinelander, WI, modified the marking gauge from Issue No. 82 so it wouldn't follow the grain of the wood so easily. He simply removed the marking point and replaced it with a washer. The washer was sharpened by attaching it to a bolt and locking it in position with a hex nut. He then chucked the bolt in his drill press (see inset photo) and used a file to sharpen the edges of the washer.*

▲ *An empty Parmesan cheese container is how **Brian Miller** of Parma, OH, stores his disposable gloves. The screw top makes the jar easy to fill and the flip-top slot lets you remove gloves one at a time.*

► *Jay Moses of Springfield, IL, uses a 3-ring binder to organize and store his sandpaper. The dividers in the binder are labeled to identify different grits of sandpaper so they can be easily found when needed. The binder lays flat when opened and can be quickly closed and placed on a shelf for easy storage.*




# routing Dadoes & Grooves

## All you need is a hand-held router, a straight bit, and a simple jig.

Dadoes and grooves are the bread-and-butter cuts in woodworking — not flashy, just strong and easy to make. Dadoes are cut across the grain of the workpiece and grooves are cut with the grain. And I usually use my table saw to cut them. Unless the workpiece is long and awkward. That's when I reach for my router.

There are several reasons why using a router makes sense for dadoes (or grooves). One benefit is that a straight bit makes a precise cut to an exact width. It also leaves a flat-bottomed groove with almost no chipout. So if your joint is exposed, you will have a tight, gap-free joint. And, with a router, you can easily fine-tune the size for a perfect fit.

**A Simple Jig.** To guide the router for straight, square cuts, I made a jig that looks like a drafting T-square. In the drawing at left, you can see how the jig is built. Besides holding the fence square to the workpiece, the jig also has an alignment notch cut into it. This notch shows you exactly where to align the jig on the workpiece. This way, it's quick to set up and there's no guess work involved.

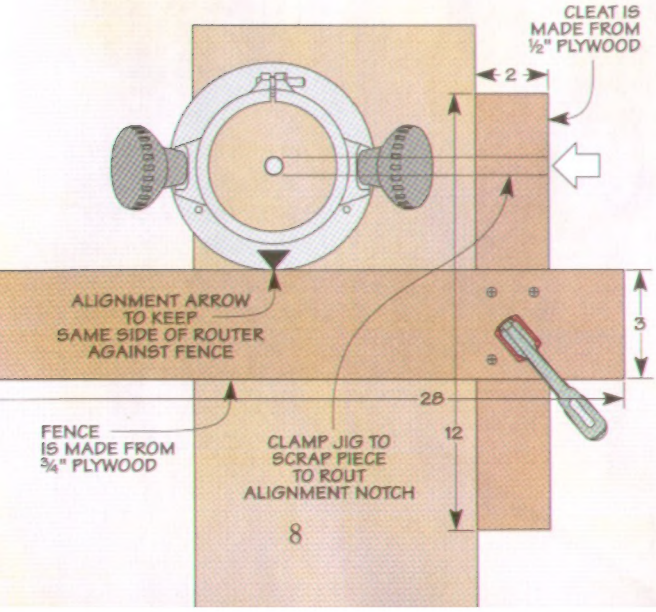
Using this jig goes a long way toward routing accurate dadoes. But there are a few other things you can do to get the best results.

**Router Setup.** The first two things have to do with setting up your router. For example, I've found that the bases of some routers aren't perfectly centered on the bit. This slight variation can lead to inaccurate results.

To get consistent results, I put an arrow on the router base (photo above). This allows me to easily keep the same side of the router against the fence.

The second step is to set the bit depth correctly. Taking too big of a bite places a lot of stress on the router motor and can overheat the bit. So I like to set the bit to take no more than a ¼"-deep pass. For routing deeper dadoes and grooves, it's best to rout them in several, shallow passes.

**Using the Jig.** At this point, you're ready to put the jig to work. Start by placing it on the workpiece with the edge of the notch on the layout line. Then clamp it in place. Note: On wide panels, it's a good idea to put a clamp on the both ends of the jig to keep it from shifting or flexing in use.



**Routing Direction.** Now, you can start routing. Start the router at the cleat end of the jig and rout in the direction shown in the photo on the facing page. In routing this way, the rotation of the bit will pull the router against the fence.

Here's a simple tip that can make routing go smoother: To prevent the power cord from getting hung up during a cut, drape the cord over your shoulder and hold it in your hand as you grip the router.

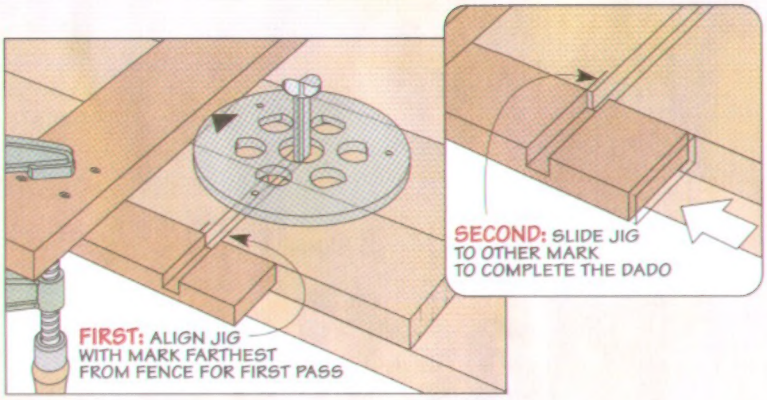
**Making Dadoes Wider.** Most of the time, a single-width pass is all that's necessary. But there are times when I need to rout a dado that's wider than the bit diameter.

It's easy to do this using the jig, but you want to make the cuts in the right order. Routing the dado in the wrong order causes you to backrout. This can pull the router away from the fence and lead to a wavy, inaccurate cut.

The drawings at right show the order. Start by aligning the jig with the layout line farthest from the fence. After making a pass, reposition the jig to align with the other mark.

Another way to make a custom-sized dado or groove (to match the thickness of a plywood panel, for example), is to use the guides shown in the box below.

With either technique, you'll find that you can rout accurate dadoes and grooves in a short time.




## technique:

# Custom-fit Dadoes

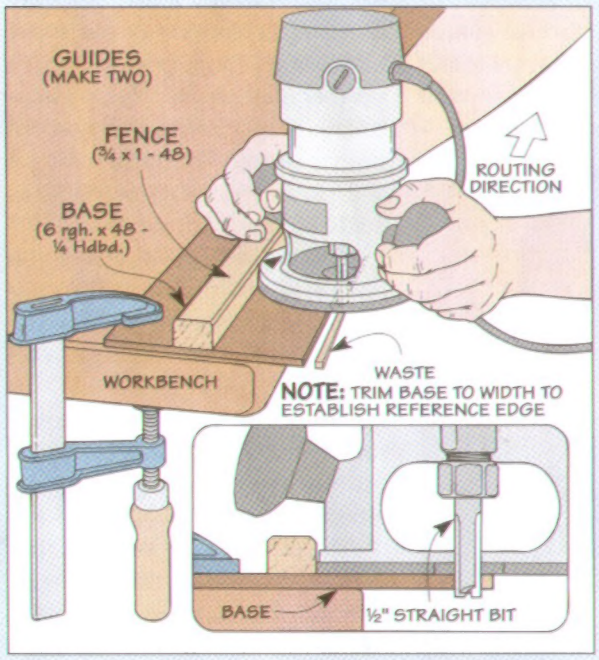
Routing dadoes or grooves to hold a plywood panel can be a challenge. The problem is it measures a little less than the stated thickness. Whenever I need to rout a perfectly sized dado to match a piece of plywood, I turn to a pair of guides like those shown in photo at right.

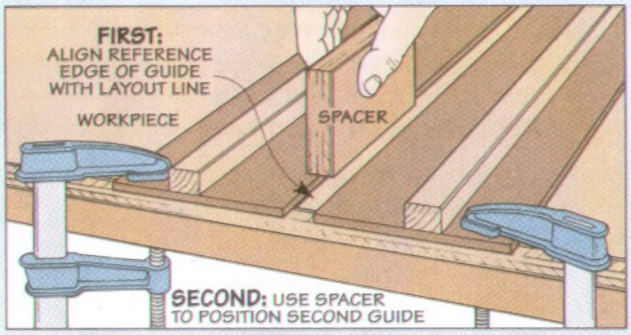
The guides consist of a hardboard base with a fence on top. I use the router and a ½" straight bit to trim the base of the guide.

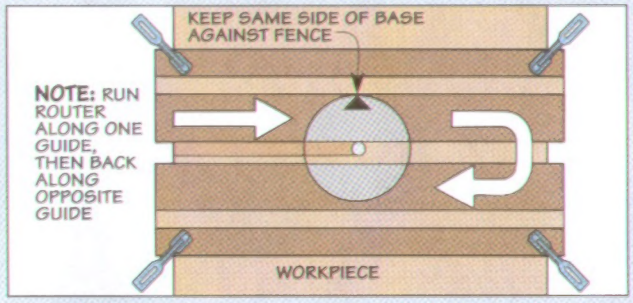
Once you've made the guides, using them is straightforward. You can use a combination square to set one of the guides square to the edge of the workpiece. Then place a plywood spacer alongside the guide and clamp the second guide against the spacer.

Now, you can rout along one edge guide then turn the router around and make a return pass to complete the dado.

▲ *Two Guides. Use two router guides to rout dadoes that exactly match your workpiece.*



# working with Plastics

## Get professional results with these tips from our shop.

Plastic is a very useful material in a woodworking shop, but working with it can be a frustrating experience. How do you cut plastic without chipping — or melting? How do you drill clean holes? And how do you get that nice, polished look on the edges? To get great results, it's all about using the right tools, techniques, and plastic.

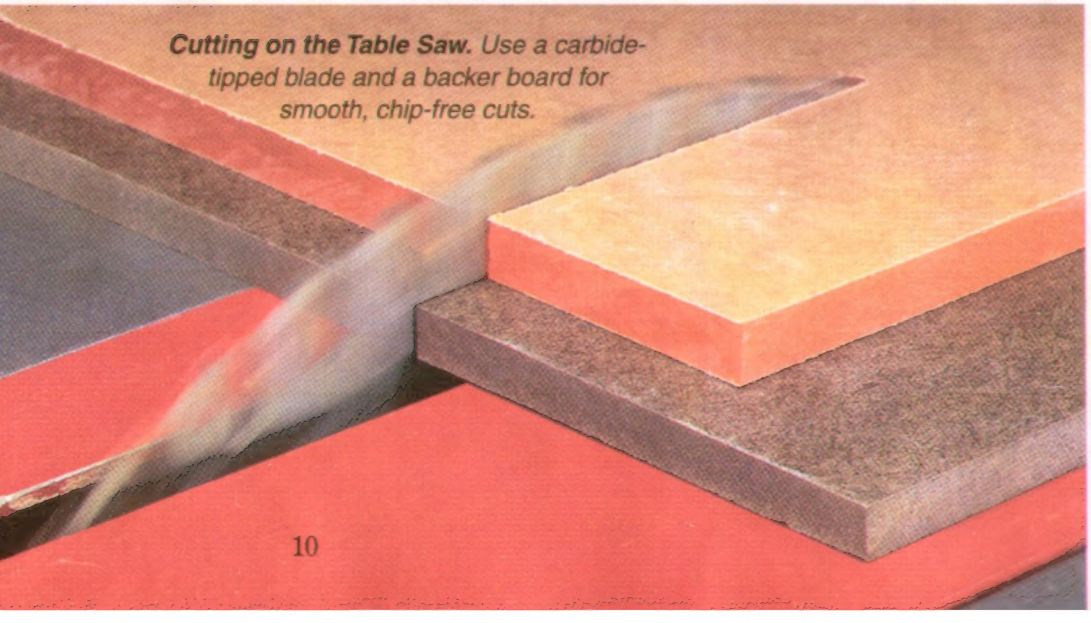
### THE RIGHT PLASTIC

There are endless varieties of plastics. But there are two readily available types that are used most often in the shop — acrylic and polycarbonate.

**Acrylic.** The most common type of plastic is acrylic. It's what you'll find at home centers and hardware stores. You probably know it by its common trade name, *Plexiglas*.

Acrylic is a good plastic to use because it's relatively soft and easy to work with. You can use it instead of glass in cabinets or as a template for pattern routing, for example.

But there's one downside to using acrylic. It doesn't have very good impact resistance, so it's not the best choice for machine guards or safety shields. You'll want something more durable. A better option for this would be polycarbonate.



***Cutting on the Table Saw.*** *Use a carbide-tipped blade and a backer board for smooth, chip-free cuts.*

*Grind a flat on both cutting edges to create a scraping action*

**Polycarbonate.** You've probably heard of *Lexan*, one of the many trade names for polycarbonate. It's tougher than acrylic. With polycarbonate, I don't have to worry about chunks of wood or metal hitting it and causing it to crack or shatter as might happen with acrylic.

**Working with Plastic.** Once you decide which plastic is best for your application, there are some techniques you can use to get good results with less effort.

For one thing, when it comes to cutting and drilling plastic, you can use the woodworking tools you probably already have.

Something else to keep in mind is that plastic is a relatively soft material. It's very easy to scratch while working with it in the shop.

But it comes with a masking material on each face. I like to keep this masking in place as long as possible to protect the surface.

## CUTTING

Plastic can be cut on your table saw and band saw, but there are a few things to keep in mind.

Whenever I cut plastic, I use a backer board to prevent chipping. (I like to use ¼" hardboard as you can see in the photos.)

**Table Saw.** Professional shops use a special carbide-tipped blade for cutting plastic. These blades have many small teeth, a modified triple chip grind, and a thin kerf.

But you can get great results with a typical woodworking carbide-tipped blade. Choose a blade with 60 or 80 small teeth.

**Band Saw.** As you can see in the photo on the right, cutting curves in plastic is really no different than cutting wood. I like to use a blade with 10 to 14 teeth per inch for smooth cuts. Even then, the edge will require further smoothing. Here again, use a backer board whenever possible for cleaner cuts.

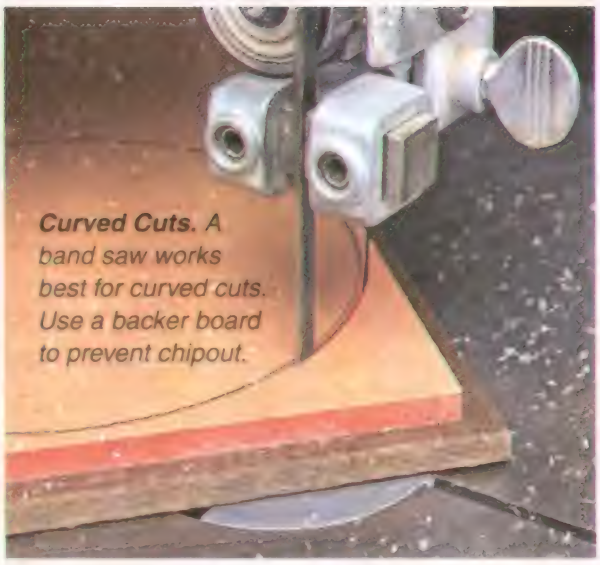
## DRILLING

Like saw blades, you can buy special bits for drilling plastic, or you can make your own. The sharp cutting edge on standard drill bits has a tendency to dig in and grab the workpiece. But, as shown in the detail photo of the drill bit on the previous page, you can take a standard bit and grind a flat on the cutting edges at the tip. This helps in drilling plastic by creating more of a scraping action instead of a cutting action which would tend to dig in.

Once you have the right bit, it's easy to drill clean holes. But you'll want to take it slow. You can build up a lot of heat very quickly.

With too much heat you can melt the plastic and get a ragged hole. I use the lowest speed on my drill press for the best results. And if I'm drilling more than a few holes at a time, I'll use a few drops of detergent in water to act as a lubricant and a coolant to get the best results.

**Finish it Up.** Now you have a number of options for finishing the edges. See the box below for the best one for the job.



***Curved Cuts.*** *A band saw works best for curved cuts. Use a backer board to prevent chipout.*

# Tips from the Shop: Edge Treatment

With these techniques and a little practice, it's easy to finish the edges of plastic and get the look you want.

**Minimal Treatment.** If you're cutting plastic for a cabinet door where the edges will be hidden, there's no point in going for a polished edge. A light sanding might be all that's necessary to ease the edges.

For a smoother finish, you can sand and buff the edges. Just use progressively finer grits to get the best results. The inset photo at right shows a sanded edge.

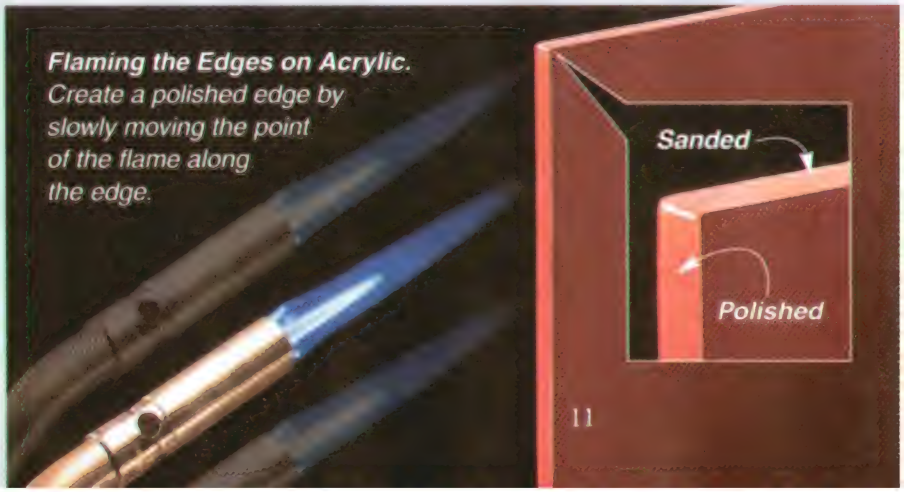
If you just want to remove rough saw marks and make the edge a little smoother, you can use a cabinet scraper (see photo at far right).

**Jointing.** Some fabricators actually use a jointer with carbide knives to smooth the edges. You can accomplish the same thing using your router table and a carbide bit as in the upper left photo at right.

**Flaming.** For that "finished" look on acrylic, you can flame-polish the edges with a torch. The trick here is to hold the very tip of the flame at a right angle to the edge (photo at right). To prevent bubbling and scorching, keep the flame moving. It's best to practice on some scrap first to get the hang of it. And don't try flaming polycarbonate — it'll scorch or burn. But you can sand and buff the edges to get that polished look.

▲ ***Your Router as a Jointer.*** *Use a carbide bit in your router table for smooth edges.*

***Scraping the Edges.*** *You can use a cabinet scraper to remove saw marks for a smooth edge.*




***Flaming the Edges on Acrylic.*** *Create a polished edge by slowly moving the point of the flame along the edge.*

# Brazing band saw blades

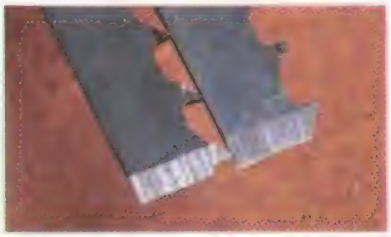
## Don't let a broken band saw blade put you out of commission.

The first time I heard about brazing your own band saw blades, my initial reaction was "why bother?" After all, band saw blades aren't really that expensive.

But if you've ever had a band saw blade break — and didn't have an extra blade on hand — you know how frustrating it can be (especially if the blade is still fairly new). That's where brazing comes in. It's a simple process that allows you to repair a broken blade and have your band saw up and running again in almost no time.

Brazing is also useful if you own a band saw that takes a blade length that isn't readily available. You can buy band saw blade stock in bulk and make your own blades to any length you need.

**Grinding the Bevels.** *With the aid of a simple jig, matching bevels are ground on the ends of the blade.*



▲ *Scarf Joint. To create a strong joint, the bevels should be at least a 1/8" wide to provide plenty of surface area for the solder.*

**Welding vs. Brazing.** Band saw blades are joined together in one of two ways. Nearly all blades sold today are welded. The ends of the blade are ground square and then butted together while a strong electrical current is passed through them. The heat from the current actually "melts" the ends of the blade and fuses them together.

Welding produces a very strong joint. But a band saw blade welder is a fairly expensive piece of equipment, and out of the reach of most home shop owners. A less expensive option is to braze the ends of the blade together.

Brazing is an old technique that has been used to join band saw blades for decades. Although it's been more or less replaced by welding, it's a simple enough process that you can do in your own shop without much in the way of equipment. All you need is

a grinder, a torch, solder, flux, and a jig to hold the ends of the blade. You can purchase a band saw blade brazing kit that has most of the items you need to get started (see box below).

## BRAZING PROCESS

There are essentially three steps in brazing a band saw blade — grinding the ends to create a scarf joint, brazing the ends together, and then grinding the joint smooth.

**Grind the Ends.** If you're repairing a broken blade, chances are the ends of the blade are uneven. So, the first step is to grind the ends square. Once this is done, you can grind matching bevels on the ends of the blade to create an overlapping joint (see upper left photo). This is probably the most important step of the whole process because the strength of the brazed joint will depend upon how well the two ends fit together.

The brazing jig I used includes a hold-down to help you grind the bevels (see lower photo on opposite page). This jig ensures that the bevels are even and ground at the same angle so the two ends mate perfectly. To ensure plenty of surface area for the solder, the bevels should be about $\frac{1}{8}$" wide.

**Cleaning and Fluxing.** In order for the solder to adhere to the metal, the ends of the blade need to be clean and free from any burrs left behind by the grinding. So I lightly sand the last $\frac{1}{2}$" or so of each end of the blade and wipe them off with denatured alcohol.

▲ *Check Fit. After cleaning the ends of the blade, place them in the brazing jig and check the fit.*

Once you've cleaned the ends of the blade, you can clamp them in the brazing jig and apply the flux. The purpose of the flux is to prevent the metal from oxidizing when you apply the heat from the torch. Just brush it on both ends of the blade (see upper right photo).

**Brazing.** After aligning the ends of the blade in the jig, you're ready to do the actual brazing. To start, cut a small piece of solder and place it directly over the joint. Then use a propane torch to heat the blade from below, keeping the flame moving. Once the metal reaches the right temperature, the solder will melt and flow into the joint by capillary action.

◄ *Apply Flux. Using a small brush, apply flux to the mating surfaces of the joint.*

◄ *Place Solder. After lining up the ends of the blade, cut a small piece of solder and place it directly over the joint. A torch is used to melt the solder. (See photo on opposite page.)*

**Grinding.** Once the soldered joint has cooled down (a few minutes), you can grind the joint smooth (see lower left photo). A flush joint will ensure that the blade runs smoothly when it's reinstalled on the band saw.

There's just one thing to keep in mind. Each time you braze a blade, you shorten its length a bit. But you should be able to repair a blade two or three times before it becomes too short to fit on your saw.

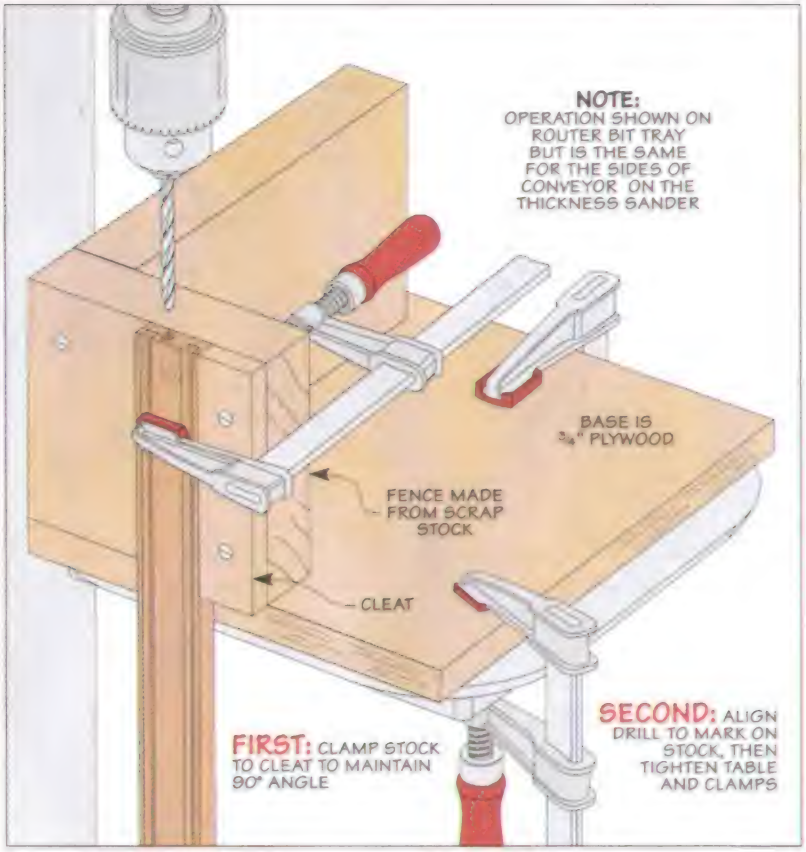
▲ *Grind the Joint Smooth. A rotary tool is ideal for removing the excess solder and grinding both sides of the joint smooth.*

## Brazing Supply Kit

There are a number of band saw blade brazing kits on the market. But they all include the same basic components — solder, flux, and a jig for holding the ends of the blade while you're brazing them together. (For sources, see page 51.) The only other equipment you'll need is a small propane torch and a bench grinder.

# Shop Short Cuts

## Vertical Drilling Jig

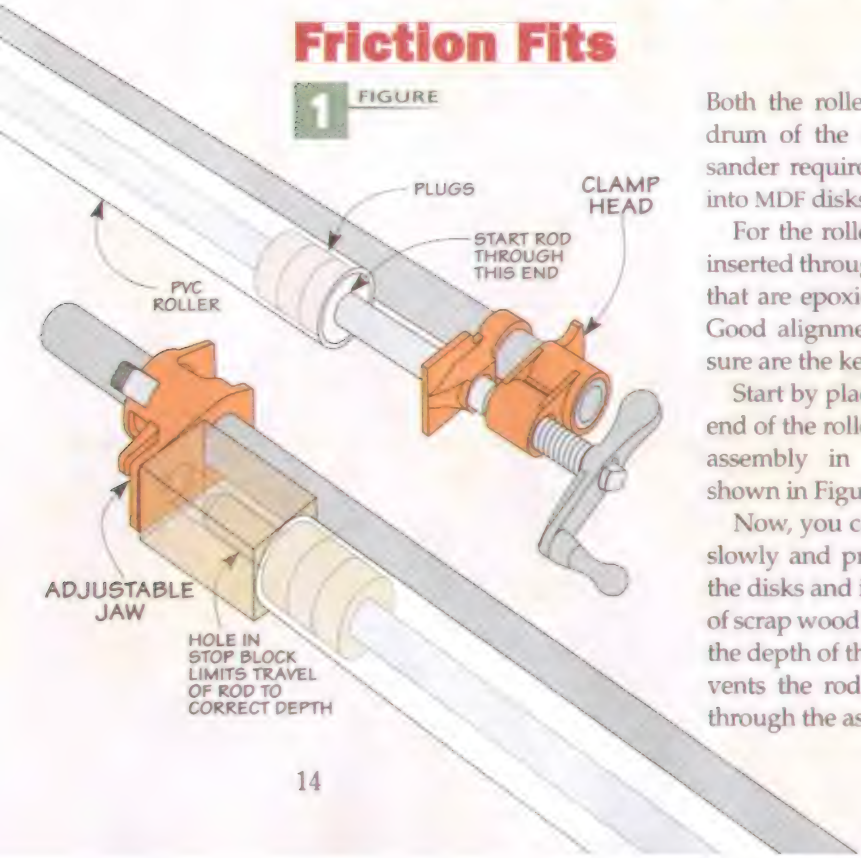



Two projects in this issue, the router bit cabinet and the thickness sander, require drilling a hole in the end of a long workpiece. This can be a challenging task. You may be tempted to pull out the hand drill and "eyeball" the alignment. But there's an easier and more accurate way to do this operation.

You can build the jig shown in the illustration above from scrap wood and plywood. It's simply a fence with a support screwed to the back to keep it square. A cleat is attached to the fence to register the stock. The fence assembly is then screwed to a plywood base that clamps to the drill press table.

To use the jig, first loosen your table and swing it to the side. Then clamp the workpiece to the cleat and position the jig on the table. Swing the table back under the bit and adjust the alignment. When you've got it centered, just tighten up the table and clamps, then drill the hole.

## Friction Fits

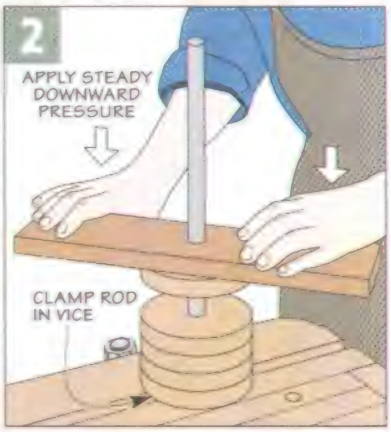



Both the roller assembly and the drum of the shop-built thickness sander require fitting a metal rod into MDF disks.

For the roller assembly, a rod is inserted through a set of three disks that are epoxied into a PVC roller. Good alignment and steady pressure are the keys to this operation.

Start by placing the rod into one end of the roller and put the whole assembly in a pipe clamp, as shown in Figure 1.

Now, you can tighten the clamp slowly and press the rod through the disks and into position. A piece of scrap wood with a hole drilled to the depth of the final exposure prevents the rod from going too far through the assembly.




In the case of the disks for the sanding drum, begin by securing the rod in a vise. Then just drill a slightly oversized hole in a piece of wood. You can use this piece to press the disks onto the rod.

# Supporting a Disk

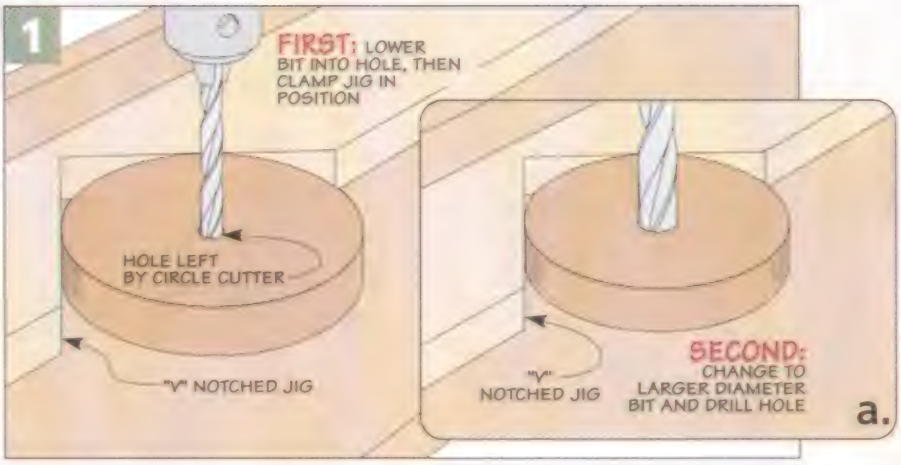
All of the MDF disks for the drum on the thickness sander require additional drilling. First, the center hole left by the circle cutter must be enlarged to fit the metal rod. Then, the two end disks each need holes to hold the locking wedges.

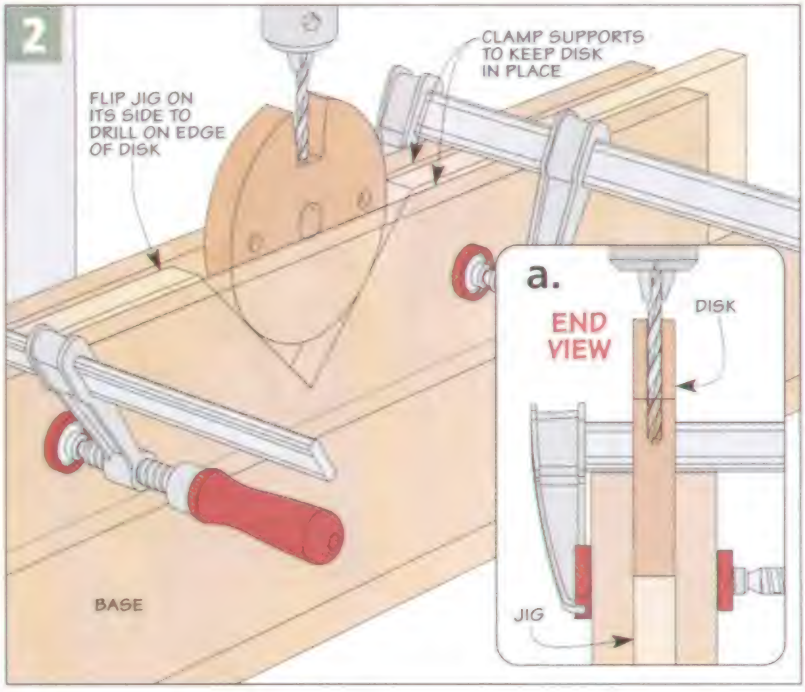
Working with round workpieces presents a few problems. When lying flat, they don't offer a square reference edge to put against a fence. When held vertically they roll, making drilling difficult.

The answer to both problems is the simple, notched auxiliary fence made from scrap MDF or plywood that you see in Figure 1.

The easiest way to enlarge the holes in the sides is to simply lay the disk flat on the table with a bit the same diameter as the hole in the chuck. Lower the bit into the disk and clamp the notched jig to the table. Now, you can put the larger diameter bit in the chuck and drill perfectly centered holes in each of the pieces (Figure 1a).

Drilling the hole in the two end disks involves a very similar operation — only it's done sideways, like you see in Figure 2. Turn the jig vertically and place another piece of scrap on the outside. Clamp them both to the fence and you'll easily be able to hold your disks in position in the notch.

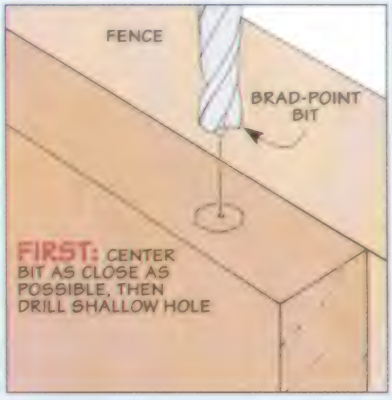


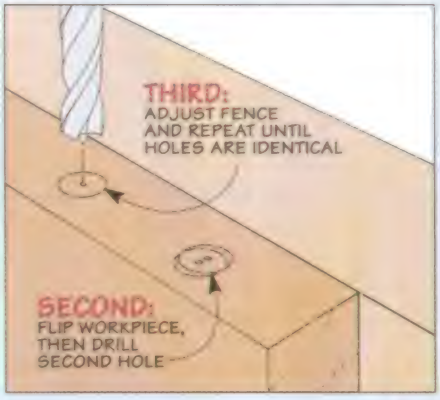




# Drill Press Tip:
# Finding a Centerpoint

Drilling a series of perfectly centered holes, like you need for the center finder on page 24, can be a little tricky. Rather than pulling out rules and marking gauges, try this handy tip.

With a fence on your drill press and a brad-point bit in the chuck, place your stock against the fence and approximate the center by lowering the bit just enough to scribe the surface. Now, turn the piece around and place the opposite face against the fence and try it again. The difference in the marks will show you how far away from true center you are. You just adjust the fence until the marks are aligned and you're done.



# router bit Storage System

## Pivoting bit trays give this cabinet a different spin.

One benefit of starting a new project is my collection of router bits often grows. But my ever-increasing number of bits was leading to an ever-decreasing amount of storage for them.

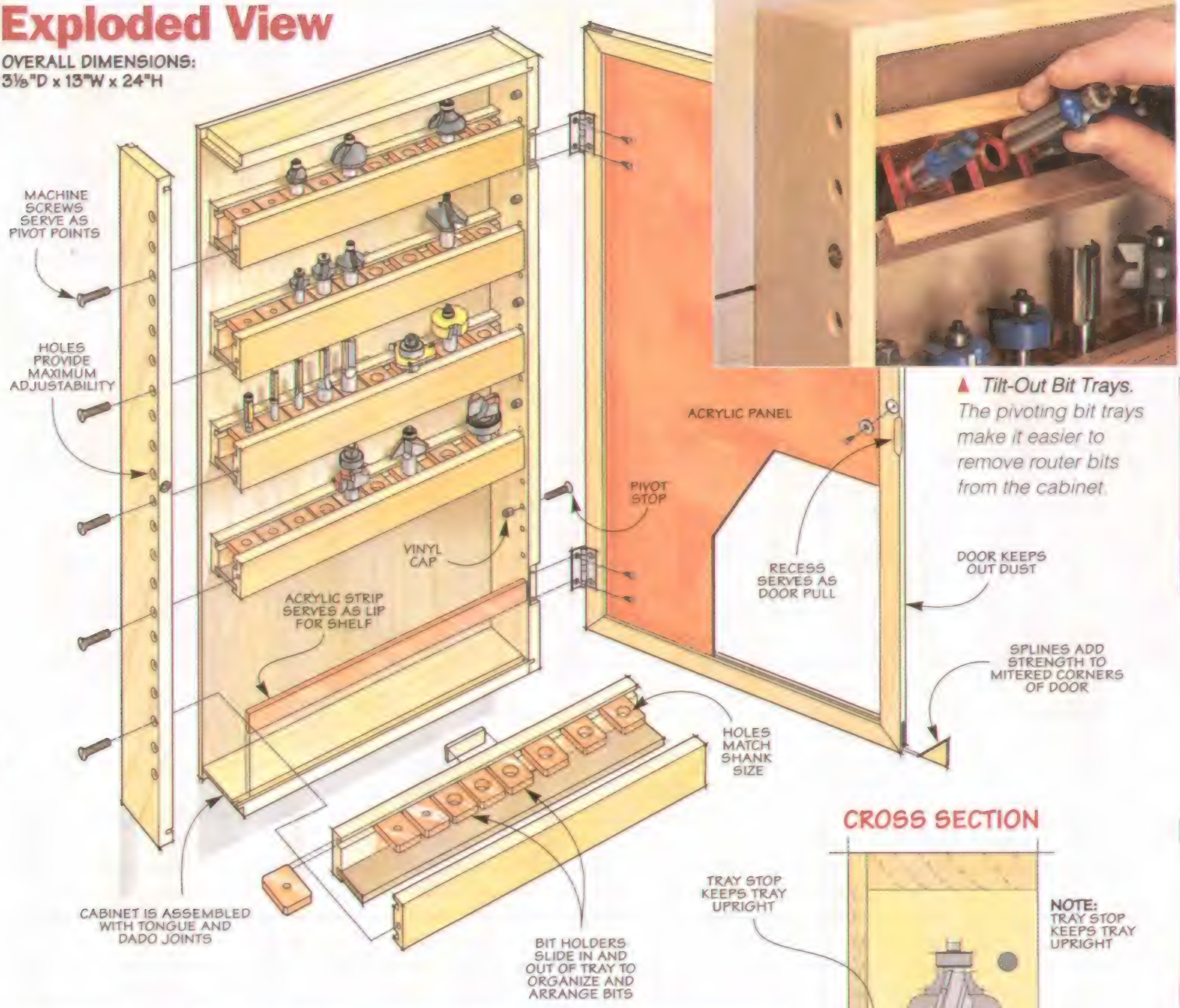
What I needed was something that could adapt to my growing assortment of router bits and also make it easy to find and get at any bit I needed. The cabinet you see pictured here fits the bill.

This cabinet is so handy, not only because the tray positions are adjustable, but also because the trays pivot outward. That means you don't need a lot of space between the trays to get your bits out. Simply pivot the tray forward, and you have easy access to the bit you need.

The trays also have sliding bit holders. Instead of losing space between bits of various sizes, you can adjust the space between them so there's no extra gaps. And changing the setup is quick and easy when you add bits.

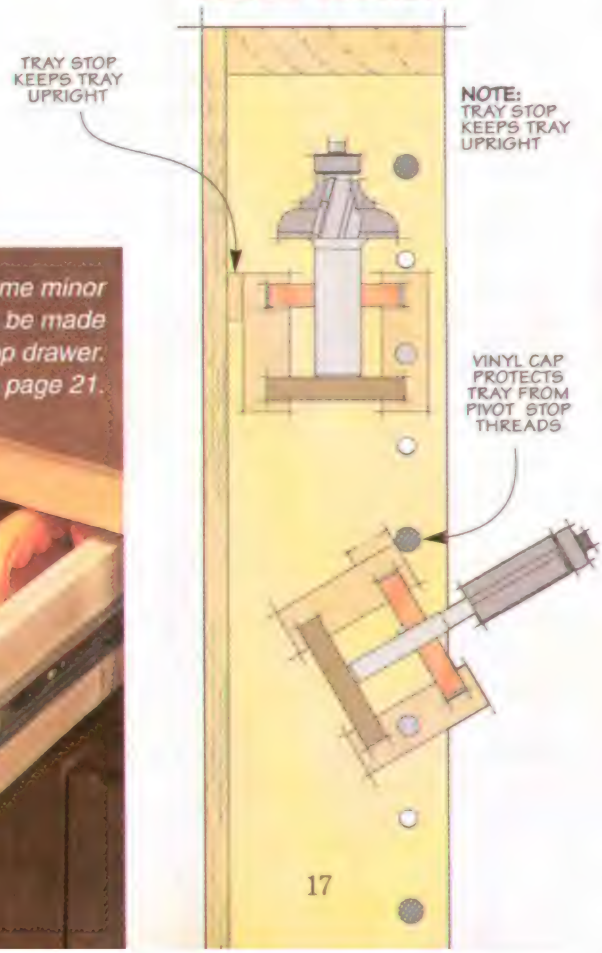
# Exploded View

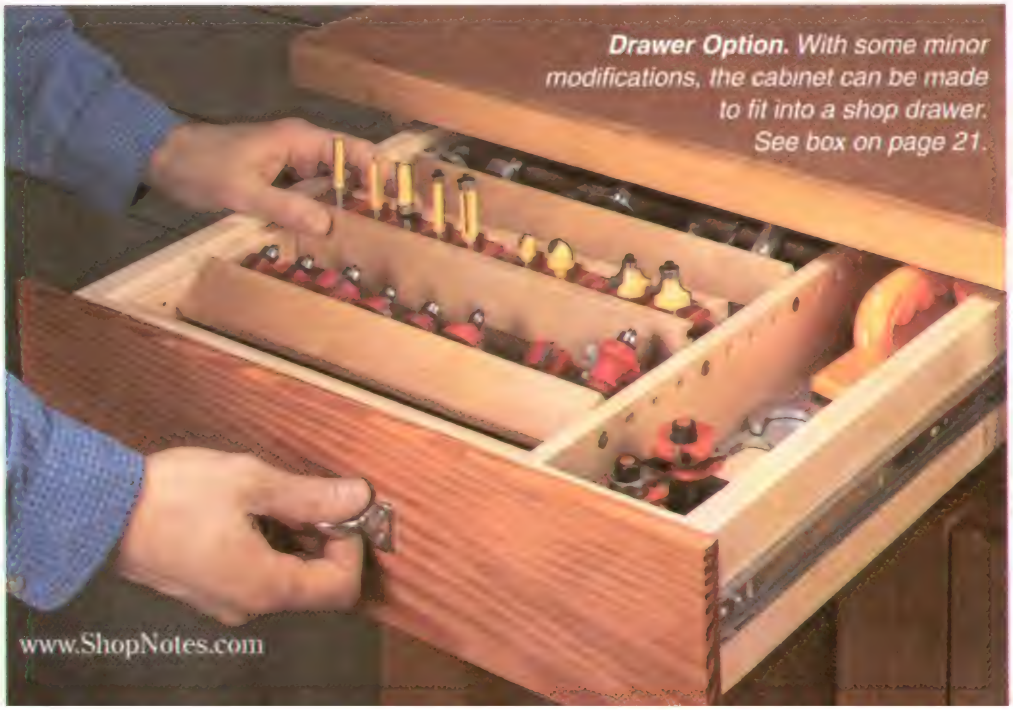
**OVERALL DIMENSIONS:**
3⅛"D x 13"W x 24"H



▲ ***Tilt-Out Bit Trays.*** *The pivoting bit trays make it easier to remove router bits from the cabinet.*

## CROSS SECTION



***Drawer Option.*** *With some minor modifications, the cabinet can be made to fit into a shop drawer.* *See box on page 21.*

## building the
# Cabinet

▲ *Tapping the Holes. Cutting threads into the holes will hold the machine screws in place.*

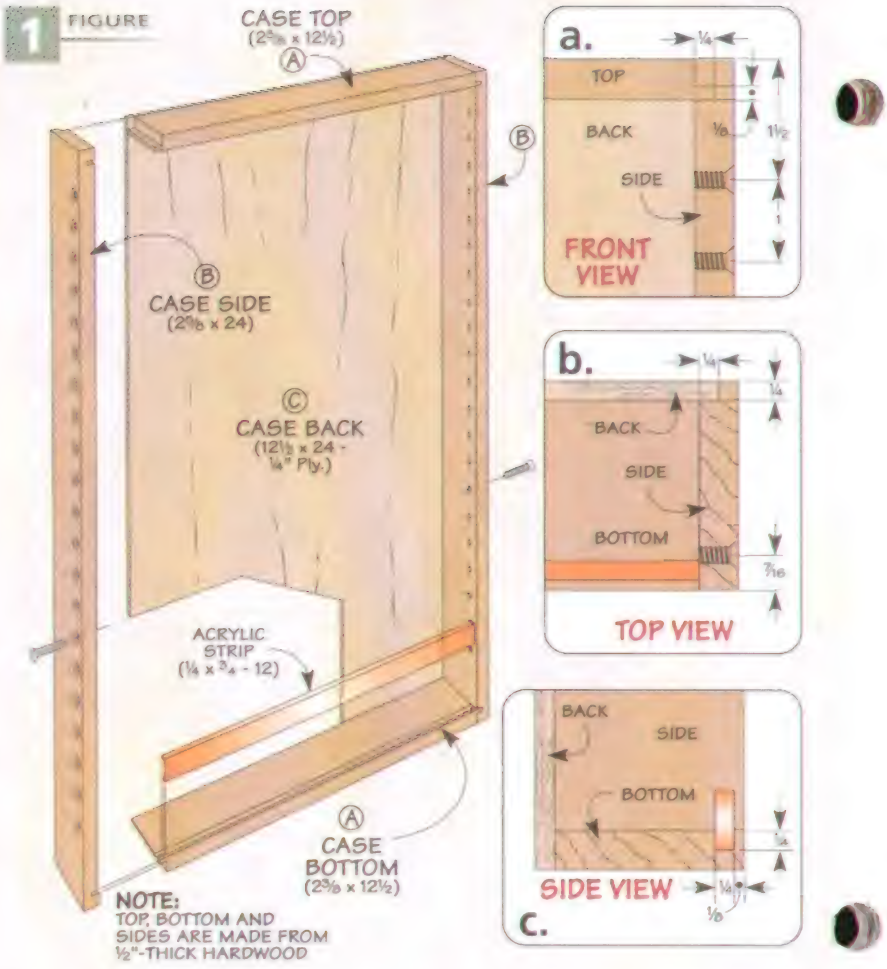
I started building the cabinet by working on the case. As you can see in the drawing on the right, there's really nothing unusual about the case itself — it's just a shallow hardwood box with a plywood back panel.

The only thing you really need to be aware of is that the two sides are wider than the top and bottom. That's so a rabbet can be cut into the back edges of the sides to hold the back, as Figure 1b shows. The top and bottom of the back simply overlap the back edges of the top and bottom of the case.

**The Joinery.** Once the parts are sized, you're ready to start on the joinery. I like to use tongue and dado joinery because it's simple to make, yet strong (Figure 1a). And I like to cut the dadoes first. Then, it's a simple matter to size the tongues to fit the dadoes.

**Cut the Bottom Groove.** After the joinery is complete, you'll need to cut a groove in the case bottom. This groove will hold a narrow strip of acrylic (*Plexiglas*). This acrylic strip will serve as a "lip" that will allow you to turn the bottom into a small bin to hold all sorts of odds and ends, as you can see in Figure 1c.

FIGURE 1




**Drilling the Holes.** With the sizing and joinery all complete, you can turn your attention to drilling a series of holes in the sides. These holes accept machines screws that allow you to adjust the location of the bit trays within the cabinet. The box at the bottom of the page shows how I drilled the holes, and also points out a couple of things that will make this part of the process go a little smoother.

**Tapping the Holes.** Once you've drilled and countersunk all the holes, there's one more thing to do to them. And that's to tap each hole with a set of threads (see photo in left margin).

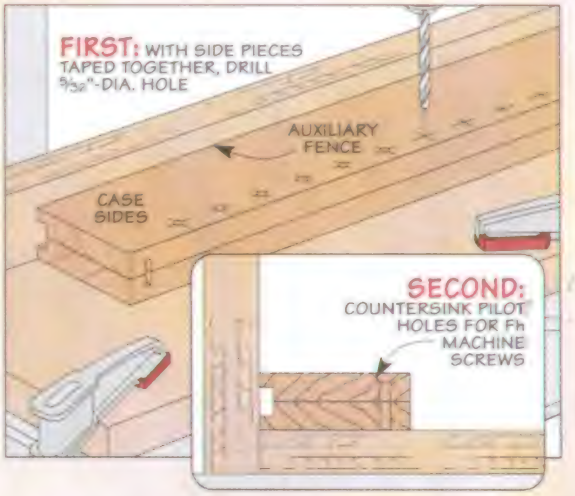
The reason for this is simple. The machine screws need something to "grab" to keep them in place, especially as you pivot the trays in and out. And tapping also allows the holes to withstand some wear and tear if you reposition the bit trays in the cabinet a lot.

**Final Details.** When you're finished tapping all the holes, you can go ahead and assemble the case. Now it's time to tackle the door.

## Drill Them Together

For the trays to pivot correctly, the holes on either side must align with each other. The best way to do that is to drill the holes in both sides at once (see drawing at right).

First, it's a good idea to set up a fence on your drill press to make sure the holes are all drilled the exact same distance from the edge. Then, you can go ahead and drill the holes down the front edge of the case sides. When that's done, add a countersink to those holes, as shown in the detail drawing.




### THE DOOR

Since my router gets a pretty good workout in my shop, it stands to reason this cabinet door will see some heavy use as well. So, I

needed the cabinet door to be sturdy and up to the task.

The narrow door frame is lightweight and provides good visibility to my router bits. And it's put together with simple, splined miter joinery for added strength.

**Making the Parts.** The first step is to cut the door frame parts to size and miter the ends of the parts. Next, you can take the parts to your table saw and cut the centered groove to hold the acrylic panel.

**Acrylic Panel.** I used acrylic as the door panel so I could see my router bits without having to open the door. Plus, it gives this cabinet a little different look than the other cabinets I have in my shop. Page 10 gives some tips on working with acrylic and other plastics.

**Assembling the Door.** Now you can assemble the door frame around the acrylic panel, glue it up, and clamp it all together. One trick I learned was to line the door up with the case when assembling it. Since the case is already squared up, it will serve as a template for squaring the door.

Once the glue dries on the door frame, you can take the frame over to your table saw and cut the kerfs in the mitered corners for the splines, as you can see in Figure 2a. The box below shows how I added the splines in the assembled door.

**Adding the Details.** Then, to finish up the door, you can rout a cove recess into the door frame that will serve as a finger pull to open the cabinet door.

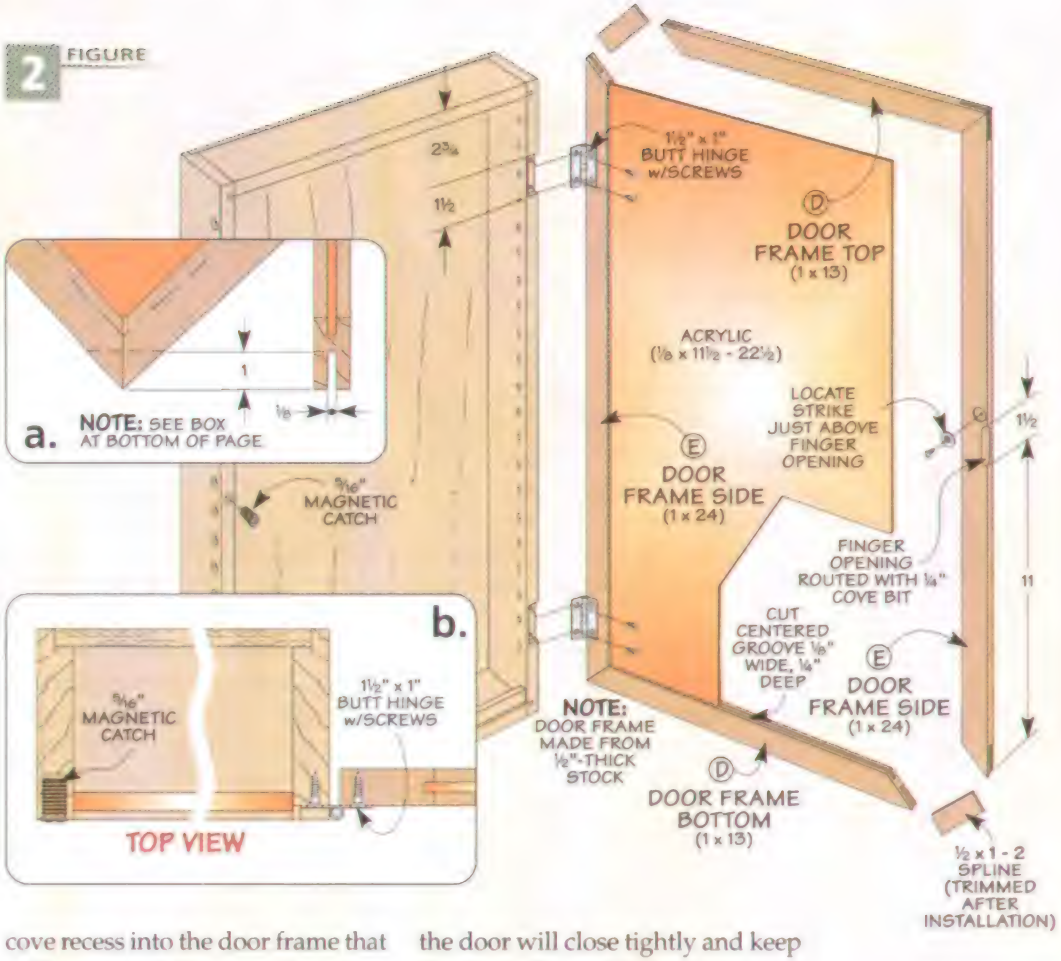
The next step is to cut the mortises for the butt hinges. To make it easier to align the door with the cabinet, the hinges are only mortised into the cabinet, as you can see in main drawing above.

However, the depth of each mortise should equal the diameter of the barrel of the hinge. This way, the door will close tightly and keep the dust off your bits.

The final step here is to install the magnetic catch and strike plate. You'll notice that the strike plate is installed just above the finger pull in the door (main drawing above).

With those details accomplished, you can attach the door to the case, as you can see in Figure 2b above. With the cabinet complete, it's time to work on the bit trays.

FIGURE 2



▲ *Splined Miter. Splines strengthen the miter joints of the door frame.*

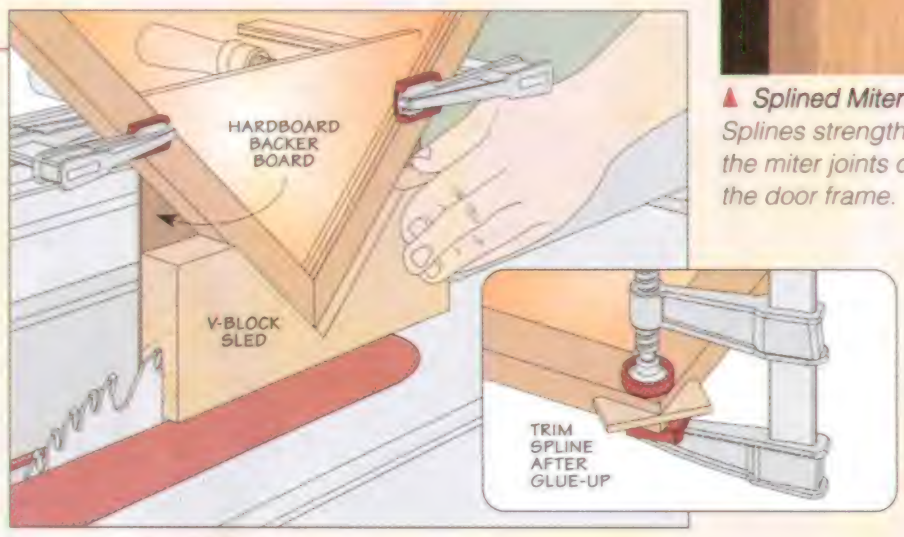
## Splined Miters

To cut the kerf for the spline, I used a simple jig made from "two-by" stock that slides along the rip fence of my table saw.

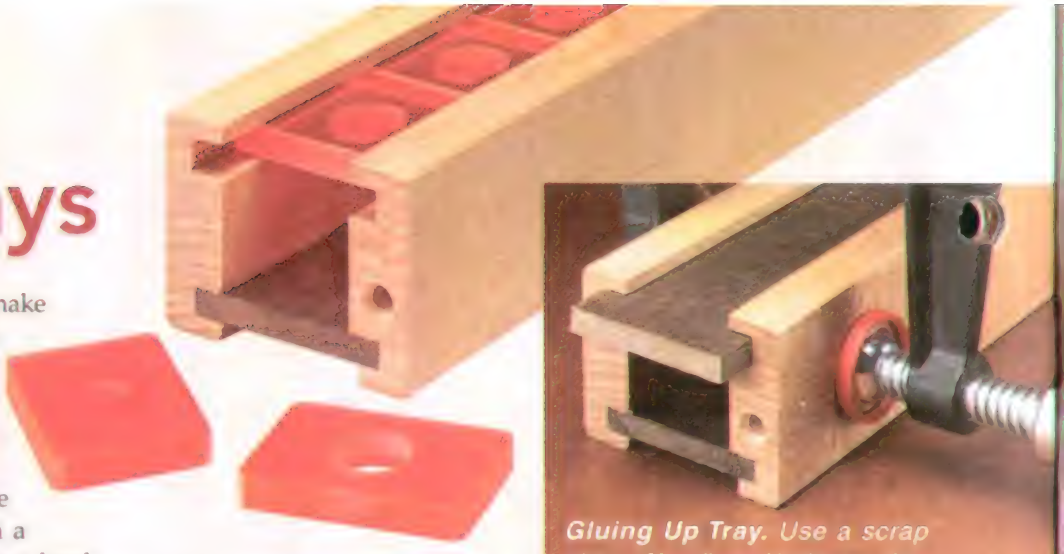
I cut a 45° angle into the "two-by" to form the sled that will hold the glued-up frame in place. For more vertical support, I added a hardboard backer board to the jig.

Next, all you need to do to cut the kerf is to set the frame in the jig and make a pass across the saw blade (see main drawing at right).

Then, you can cut the splines and glue them into the kerfs (inset drawing). When the glue has dried, remove the excess spline material with a handsaw and sand it flush.



# making the Bit Trays



The bit trays are what make this storage cabinet so versatile. Their pivoting action allows easier access to the bits and more storage options.

**Cutting the Parts.** The trays are little more than a front and back, joined to a hardboard bottom. Figure 3 shows how the trays go together. You can begin by cutting the fronts and backs of the trays to size. Then take those parts to your table saw and cut the grooves that will hold the bottom and the acrylic bit holders.

**Drilling the Pivots.** Now is a good time to drill the pivot holes in the fronts of the trays (see Figure 3b). For the trays to pivot easily, these holes aren't threaded like the holes in the cabinet. And they're just a little larger in diameter than the screws, so the screws can slide in and out of them if you need to move the trays. A slight countersink helps guide the screws into the holes. If you'll look at Shop Short Cuts on page 14, you'll see how to drill these holes consistently.

**Assembling the Trays.** Next, you can cut the bottoms to size and glue the trays together. To help keep the trays square while the glue dried, I placed a scrap piece of hardboard in the top slots (see photo above).

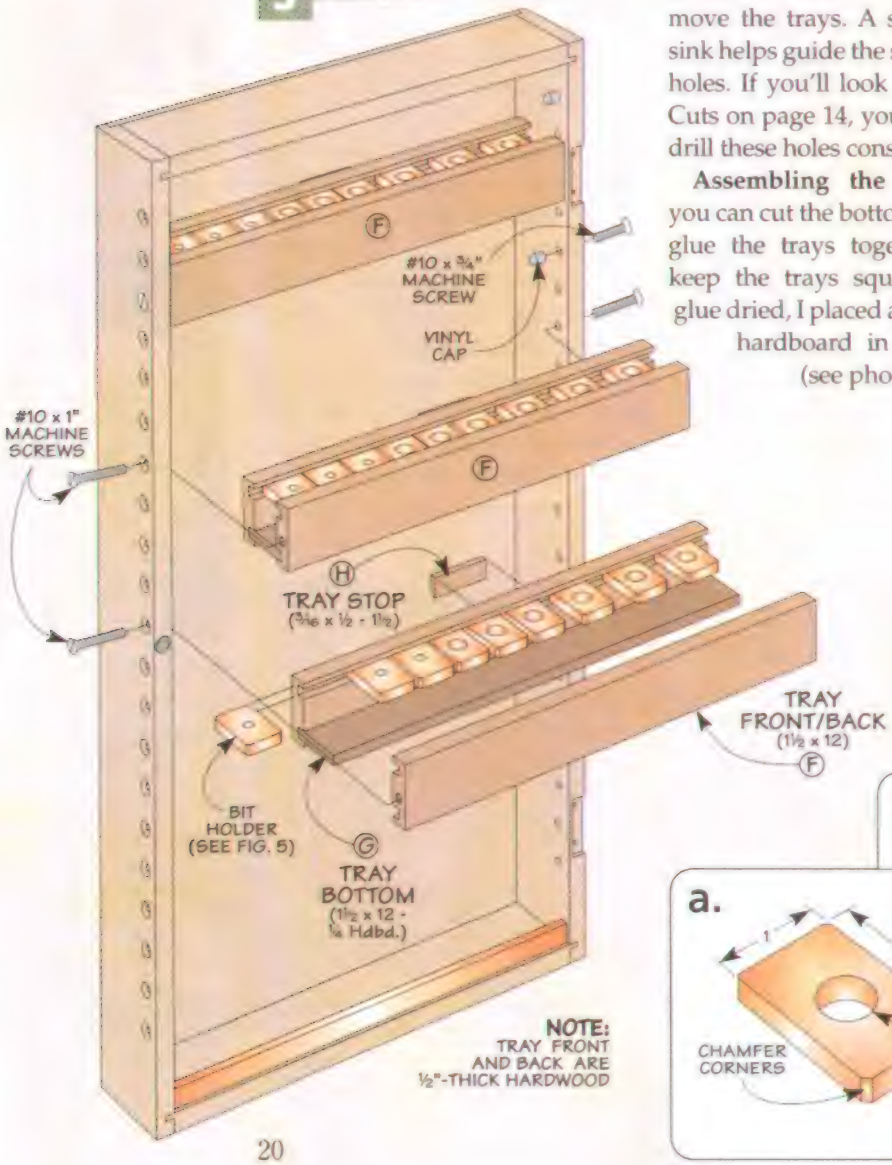
***Gluing Up Tray.*** *Use a scrap piece of hardboard in the top slots to keep the trays square while the glue is drying.*

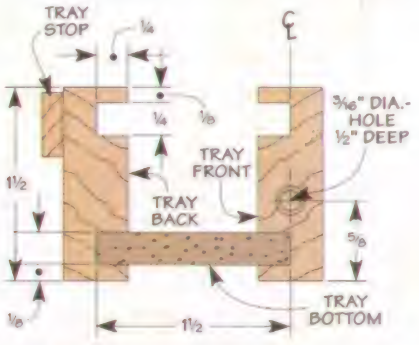
There's one more thing to add to the trays. To allow the trays to pivot, they're set away from the case back. This provides clearance. However, when the trays are upright, they might lean a little too far back and can end up resting on a router bit if you're not careful. To solve this problem, I added a tray stop to the back of the trays.

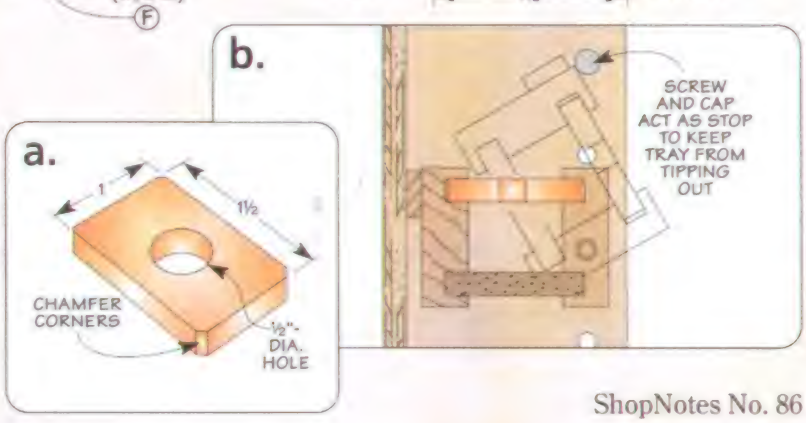
## BIT HOLDERS

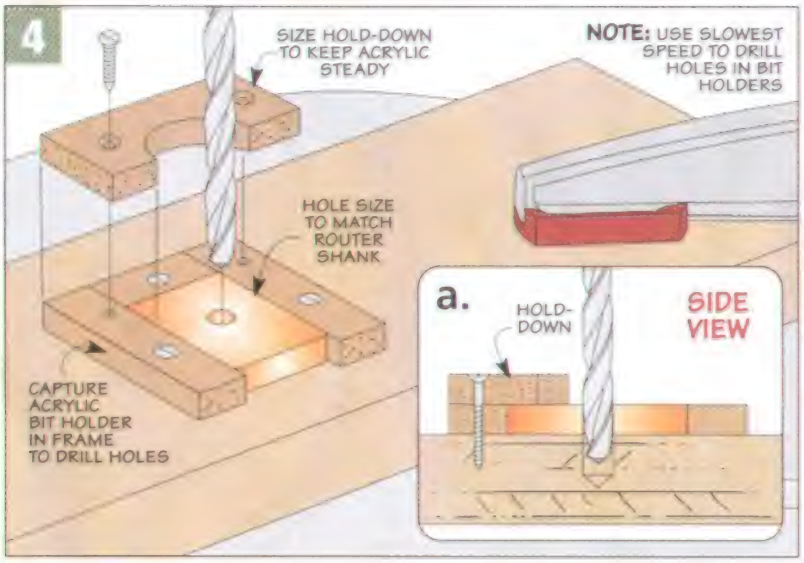
While the glue dries, you can begin working on the bit holders. Here, I used acrylic mainly because it will withstand heavy use. Holders made of wood tend to expand and

3 OVERVIEW





▲ *Pivot Stop. Adding a pivot stop will keep the trays from pivoting too far. A vinyl cap will cover the screw threads.*

▲ *Loading the Trays. Remove the pivot stop and turn the tray forward to add or remove bit holders.*

contract with humidity changes and can grip the bits so tightly they would be tough to remove.

Working with acrylic is not much different than working with wood — you don't need any special tools. For more on working with acrylic and other plastics, see page 10.

**Drilling the Holes.** After cutting the bit holders to size, I took them over to my drill press. Working with small parts on a drill press is pretty difficult. So, to help drill the holes in the holders, I built the jig you see in Figure 4. And, since I have router bits with both ¼" and ½" shanks, I made plenty of holders for both sizes. Having a few extra holders on hand allows you to add more routers bits later.

**Installing the Trays.** You're now ready to install the trays into the cabinet. First, consider how you want to arrange your bits. I decided to go by height, so all the long bits would be together and the shorter bits would be together. That way I could take full advantage of the spacing between the trays.

Then, to install the holders, pivot the trays until the slots clear the sides (inset photo at right). When you have the holders where you want them, just stand the tray up.

While the pivoting trays are a great feature, I needed a way to keep the trays from falling down and dumping the bits out. To prevent that, I added a screw above the pivot point to catch the back of the tray as it pivots (main photo above). To keep from damaging the tray, I added a vinyl cap to the screw.

All that's left at this point is to hang the cabinet on the wall and start filling it with router bits. However, if wall space in your shop is limited, you can slip this cabinet into a shop drawer, like the box below shows.

# Inside a Drawer

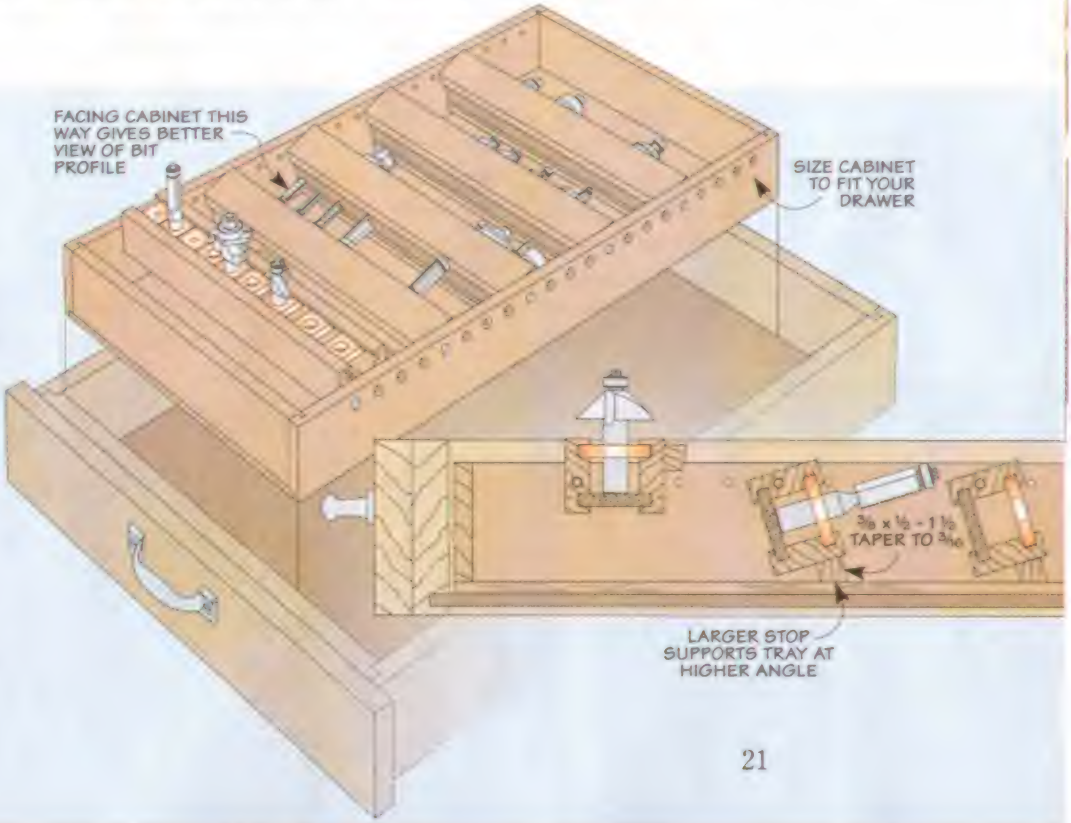
With just a few modifications, the cabinet can be stored in a shop drawer.

The first change is that you won't need the door, so you won't have to worry about mortises, hinges, finger pulls, or magnetic catches. You also won't need the pivot stops, either.

But there are a couple of things you might want to consider.

First, put the cabinet in a full extension drawer to give you complete access to all your router bits.

Second, make a larger, tapered stop for the trays. They'll rest at a higher angle, preventing the bits from sliding out of the holders.



# top-notch results with MDF

The keys to success with this versatile material are a few simple techniques.

When it comes to choosing material for a shop project, MDF (Medium Density Fiberboard) is often at the top of my list. The thickness sander on page 28 is a good example. A little bit of hardwood, some hardware, and half a sheet of MDF and you've got a real workhorse of a machine.

MDF is basically just a mixture of fine wood fibers and a binder that's pressed into plywood-like sheets. But this simple material has a lot of pluses. First off, since MDF has no "grain," it's very stable. The sheets are flat and will stay that way. And with carbide tools, it machines smoothly and easily. Topping it off, MDF is relatively inexpensive.

I take a pretty straightforward approach to assembling pieces of MDF into a project. I rely on simple rabbets and dadoes or butt joints along with glue and screws for a strong assembly. But there are a few simple tricks you should know to get the best results.

## GLUING MDF

When I'm assembling an MDF project, a bottle of yellow wood glue is always close at hand. Since MDF is made from wood fibers, it will form a relatively strong glue bond. A big bonus is that, similar to plywood, MDF offers good gluing surface on the edges and the faces.

**Edges and Faces.** When you start working with MDF, you'll quickly notice a difference between the look and feel of the outside faces and the inner core and cut edges. And this is a pretty important point when it comes to gluing.

You'll find that the outside faces of MDF are smooth, hard, and very dense. This makes face to face gluing an easy job. You'll get a glue bond between the pieces that's stronger than the MDF itself.

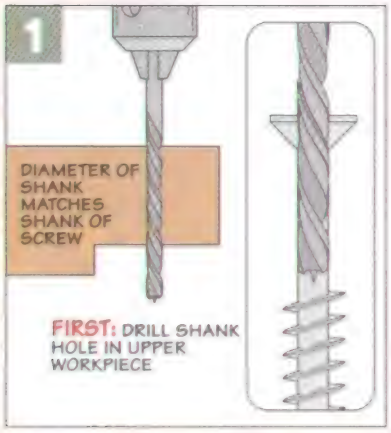
But you'll find that the edges and the core of MDF are rougher, "flakier," and more porous. What this means is that applying glue to the edge surfaces of MDF can be like pouring water onto sand. If you just go through your normal gluing routine, you can end up with a joint that's "glue starved."

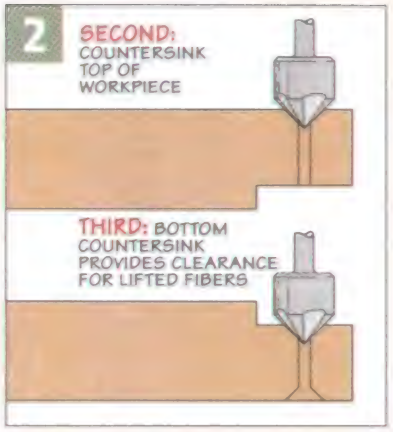
**Glue on Glue.** Fortunately, the fix to this problem is easy. The photos at the bottom of this page show the technique I like to use.

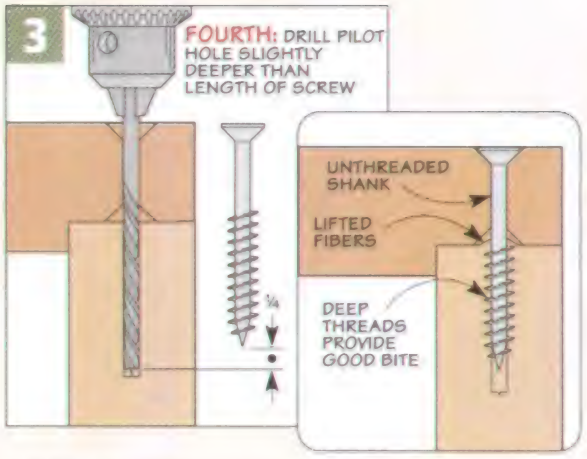
***A First Coat.*** *Start by applying a bead of glue to the surface. Then spread it with your finger.*

***Glue Starved.*** *After snugly assembling the two pieces, pull them apart. You'll find that most of the glue has soaked in.*

***Add More Glue.*** *So now, apply a second bead of glue, spread it out and assemble the joint for good.*




Basically, what you want to do is "double glue" the joint. The first layer of glue soaks in and helps seal the surface. The second application can then spread through the joint and create a solid bond.

And don't be stingy with the glue. I like to see a fair amount of squeezeout (main photo). A strong joint is worth the cleanup.

## INSTALLING SCREWS

Adding a few screws to an MDF joint can eliminate any doubts about strength and can allow you to leave the clamps on the rack.

**The Two Keys.** Although MDF is a strong, dense material, the "fibrous" structure can lead to problems when installing screws. One weakness is that a screw installed into the edge of MDF can cause it to split through its thickness. The result is a screw with no "bite"and a bulge on the surface.

The first key to avoiding this headache is a pilot hole of the right diameter and drilled to the right depth. The drawings above explain how to do this part of the job.

The second key goes hand in hand with the first — the right screw. Standard, tapered wood screws can split MDF. And their shallow threads won't hold well. A straight-shanked screw, like that shown in the right margin, is my favorite for MDF (see Sources).

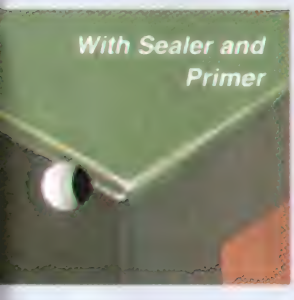
When these screws are installed in a properly sized pilot hole, there is very little chance of splitting. The unthreaded shank section allows the two pieces to draw together snugly while the deep, widely spaced threads hold tight.

**Final Tips.** There are two more things to mention. As insurance against splitting, try to keep your screws one inch or more from the ends. And when you drive the screws, be careful to not overtighten them and strip the threads.

Once you have the project solidly assembled, you'll want to give it some protection. For a few pointers on painting MDF, take a look at the box below.

▲ *Screws for MDF. These straight-shanked screws can be used with a finish washer for a cleaner look.*

# Painting: A Smooth Finish




It's always a good idea to put a finish on MDF projects. Sometimes this is nothing more than a coat of wiping varnish to protect against grime and moisture. But for some projects, like the drum sander, I prefer the extra durability of paint.

The smooth, flat surfaces of MDF make it ideal for spraying on paint. You won't need to do much in the way of surface preparation to get good results. But the more porous edges are a different story.

Just like glue, the edges of MDF readily absorb paint. What you can end up with is a noticeable contrast between the smooth faces and rough edges (top left photo).

▲ ***Edge Sealer.*** *Drywall joint compound makes a quick, easy sealer for the porous edges.*

To solve this problem, I take a couple of simple steps. First, I seal all the exposed edges with drywall joint compound, as shown in the photo above. It looks like a mess, but it actually goes on easily with a putty knife or even your finger. And when dry, the excess sands off with a minimum of effort.

Then, before applying the topcoat, I seal everything with a coat of primer (photo above). The topcoat will then build quickly to a smooth durable, film (lower left photo).

# shop-built Center Finder

The no-measure, no-math solution for laying out a centerline.

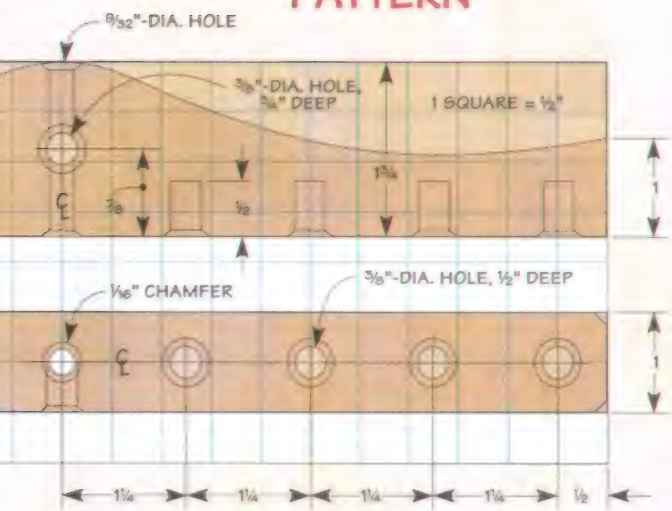
Simple solutions are often the best. That's certainly the case with the shop-built center finder you see above. Two adjustable brass rods and a pencil mounted in a wood beam — that's all there is to it.

But you can use this simple tool to quickly find the exact center of the edge or face of a board without measuring and dividing any odd fractions. All you need to do is set the adjustable rods slightly wider than your workpiece and turn the tool so the rods ride on the sides of the board. Then, just slowly pull it across the surface and you'll scribe a perfectly centered line.

Not only is this tool easy to use, but it's a snap to build. In fact, you can probably make it while you're waiting for the glue to dry on another project. It's also a great chance to use one of those special pieces of scrap you've been saving.

**Getting Started.** I started with a piece of 1⅛"-thick rosewood, but any hardwood will work great. Just make sure it's flat and the edges are square. Next, you'll want to draw the final shape on one face to serve as a reference for laying out the holes. You can use the template shown at left, or come up with your own idea. The shape won't affect the performance of the tool. But don't cut out the shape yet. You'll want to keep it square until you've drilled the holes and installed the hardware.

## PATTERN

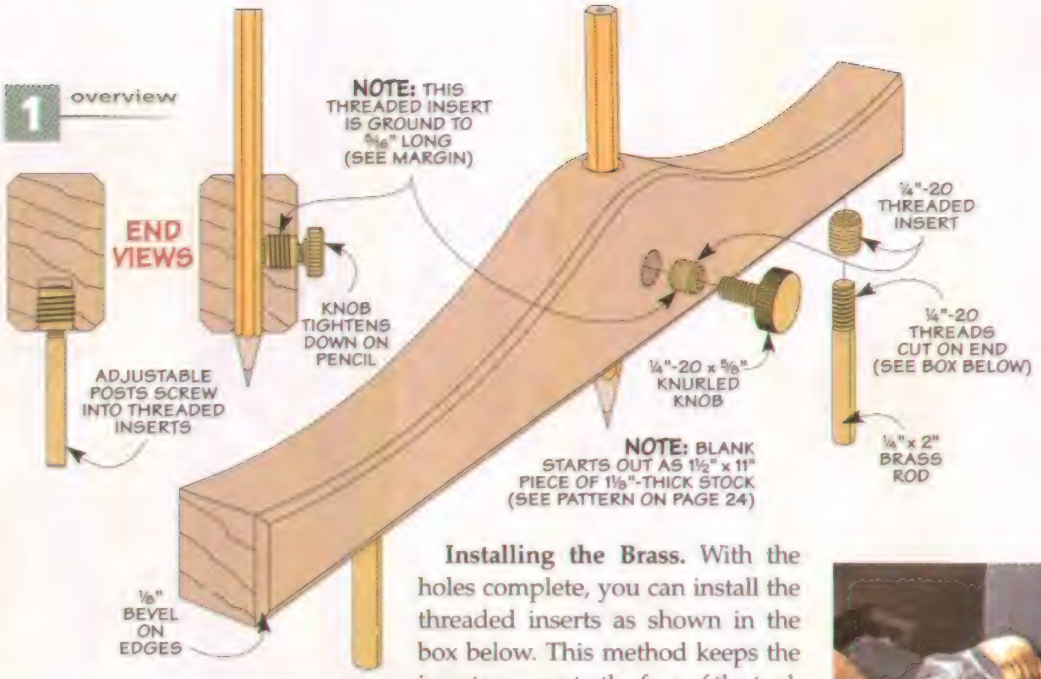


***Centering Pulls on Wide Drawer Fronts.*** *By adjusting the position of the brass posts, you can easily find the centerline even in wide stock.*

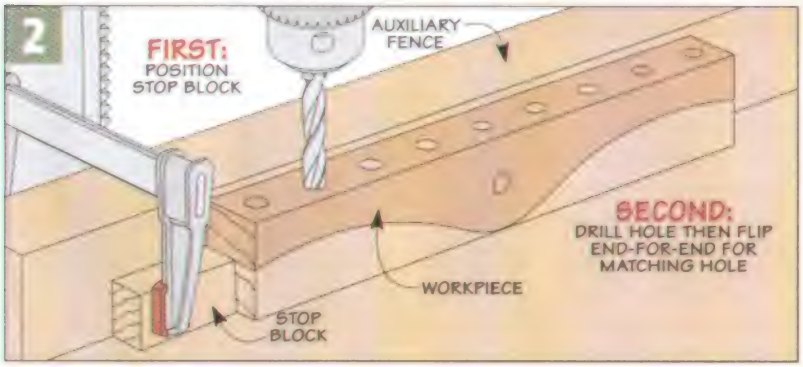
**Drilling the Holes**. Since the accuracy of this tool depends on the holes for the rods and pencil being precisely centered and uniformly spaced, the layout has to be dead-on. Check out Shop Shortcuts on page 14 for an easy way to perfectly center these holes.

To guarantee accurate spacing of the holes, I simply clamped a stop block to the drill press fence. Flip the blank end-for-end and drill a pair of matching holes, then move the stop block to drill the rest, as shown in Figure 2. There's one thing to note here. The center hole, which will house the pencil, goes all the way through the blank and is a slightly smaller diameter than the other holes.

A knurled knob in an insert on the face holds the pencil. To drill this hole, flip the blank on its side and drill a crosshole just deep enough to intersect the pencil hole.




To prevent the tearout that can occur while installing the inserts, I slightly chamfered the edge of each hole with a countersink bit. This maintains the tool's flat surface.




## Keep it Straight

▲ *Threaded Inserts. Using a piece of all-thread and two locked nuts, turn the chuck by hand to install the inserts.*

▲ *Die-cutting the Rods. Secure the rod in the chuck and clamp the die cutter to the table. Rotate slowly by hand to cut the threads.*

**Installing the Brass.** With the holes complete, you can install the threaded inserts as shown in the box below. This method keeps the inserts square to the face of the tool. For the hole in the face, you'll need to grind the insert down to 5/16" long to allow enough clearance for the pencil (photo at right).

To thread the ends of the brass rods, I used a similar technique (box below). Start with 3" long rods so you can remove any nicks caused by the drill chuck. With the die-cutter clamped to the table, put a drop of oil on the rod and slowly rotate it to cut the threads. Back out often to clear the shavings. Complete the tool by cutting the rods to final length and cleaning them with steel wool.

**Shaping and Finishing.** After cutting out the body at the band saw and sanding it smooth, I chamfered the edges at the router table. This not only adds refinement to the look of the tool, but makes using it more comfortable. Add a couple coats of finish and it's ready for use. You'll soon be reaching for this handy little tool often.

▲ *Grinding Insert to Size. Use a long bolt and two nuts locked tight to secure the insert for grinding.*

▲ *Details. Counterbores and chamfers give the tool a high-quality fit and finish.*

# flawless cuts with a Jig Saw

## Learn a few secrets to boost the performance of your saw without a lot of fuss or time.

► *Orbital Action. If your jig saw has an orbital action feature, the first step to smooth, splinter-free cuts is to turn off the orbital action.*

Using a jig saw sounds simple. Turn it on and push it through the wood. But often, the results can be pretty rough. A lot of times the cut edge is splintered and when I go around a curve, the blade bends and the saw bounces around like a jackhammer.

It's easy to just think of a jig saw as a "roughing" tool. But you don't need to settle for sloppy cuts. I found a few tips and techniques that will work to improve the cuts you make with any kind of jig saw. And, best of all, none of them will cost a lot or take much time.

**Orbital Action.** To start with, there are a couple of adjustments you can make to your saw that will help you get smoother cuts.

For example, many saws feature an orbital cutting action to power through construction lumber. In addition to the blade moving up and down, the orbital motion adds a "kick" to the blade on the upstroke. This extra push on the blade makes it cut faster.

But it also means the cut edge will be pretty rough. That's not a big deal in construction work. But when I'm using high-quality plywood or cutting curves in hardwood, I turn off the orbital action.

Now, you have the blade only moving up and down. While this means the cut will take a little more time, you'll have a lot more control and the cut edge will be smoother.

**The Right Blade.** Turning off the orbital action of the saw is a good starting point for smoother cuts. The next place to improve the cutting quality is by choosing the right blade. The drawing above shows you two blades that I keep on hand for smooth cutting.

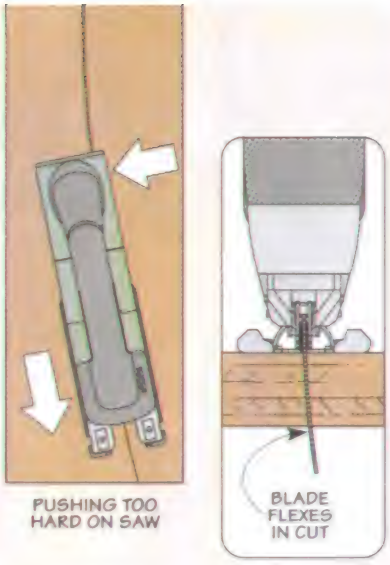
Even though they look different, each of these blades has one thing in common — a high tooth count. Packing more teeth on the blade allows each tooth to take a smaller bite with less tearout.

**Upcut Blade.** The type of blade I use most often is an up-cutting blade with 12-16 teeth per inch (left blade in drawing). Jig saws are designed to cut on the upstroke. The reason for this is better control. When the blade cuts on the upstroke, the saw is pulled down against the workpiece. This helps prevent the saw from bucking and makes it easier to steer the tool.

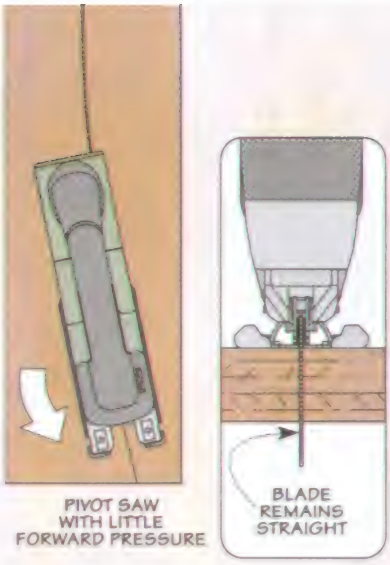
▲ *Two Blades. An upcut blade (left) with 12-16 TPI will handle most cuts. For tight corners, I use a 20 TPI blade with straight teeth.*

Because of this cutting action, any tearout on the cut is going to be on the top face as the teeth exit the workpiece. So it's a good idea to

▲ *Turn from the Front. Grip the saw directly above the blade when cutting curves. Take it slow, and let the blade do the work.*




▲ *Problem. Too much forward force on the jig saw causes the blade to deflect in the cut.*




▲ *Solution. Slow down and pivot the saw around the blade. Now, the blade stays straight.*

place the good face of your workpiece down. (In the box at right, you can see a another way to prevent tearout with an upcut blade.)

**Curve-Cutting Blade.** When I need to cut tight curves or if I need both faces of a plywood panel to look their best, I switch to a different blade. This blade has 20 teeth per inch and they point straight out. These teeth have a slicing action that leaves both faces clean.

## CUTTING TECHNIQUES

With your saw set up, you're ready to start cutting. But there's more to smooth jig saw cuts than setup. Here are a few techniques that will improve your results.

**Cutting Speed.** As you're cutting with either of these blades, you'll notice they have a natural cutting speed. This is the amount of material the blade will remove with light pressure on the saw.

I know it's tempting to push the saw full-speed ahead and get the cut done faster. But, if you relax and let the blade do the cutting, the cut edge will be much smoother.

**The Grip.** The small size of a jig saw makes it seem natural to hold it in one hand and the workpiece with the other. But you'll find the saw is easier to control if you hold it with two hands.

You can then secure the workpiece with clamps. By clamping the piece to the workbench close to the cut line, you can prevent it from vibrating and binding on the blade.

**Turning Corners.** Keeping both hands on the saw works great for straight cuts and gentle curves. But when it comes to turning tight corners, I use a different technique.

The problem you can run into is that the cut edge ends up beveled, as illustrated in the left drawing above. This comes from pushing the saw forward too hard while trying to turn the corner. Like a car skidding around a corner, this action puts a lot of pressure on the side of the blade (inset drawing).

The solution is simple. I take it slow and try not to put much forward pressure on the saw. Instead, you want to guide the blade around the corner. And, it'll feel like the saw is pulling itself along.

**Overhand Grip.** Then, to get the best control for the turn, I hold the saw with only one hand directly over the blade (photo at left). This seems like the opposite of what I said earlier, but in this position, you can better pivot the saw without pushing it to the side.

As the saw comes out of the turn, you can go back to a two-handed grip. And when you're finished, you'll see that it doesn't take a new saw to get smooth, square cuts.

## Smooth Cuts: Stop Tearout

▲ *Masking Tape. To help prevent tearout in the top face of the workpiece, you can apply masking tape to the cutline. The tape holds the fibers in place and keeps them from splintering.*

best-built
jigs & fixtures

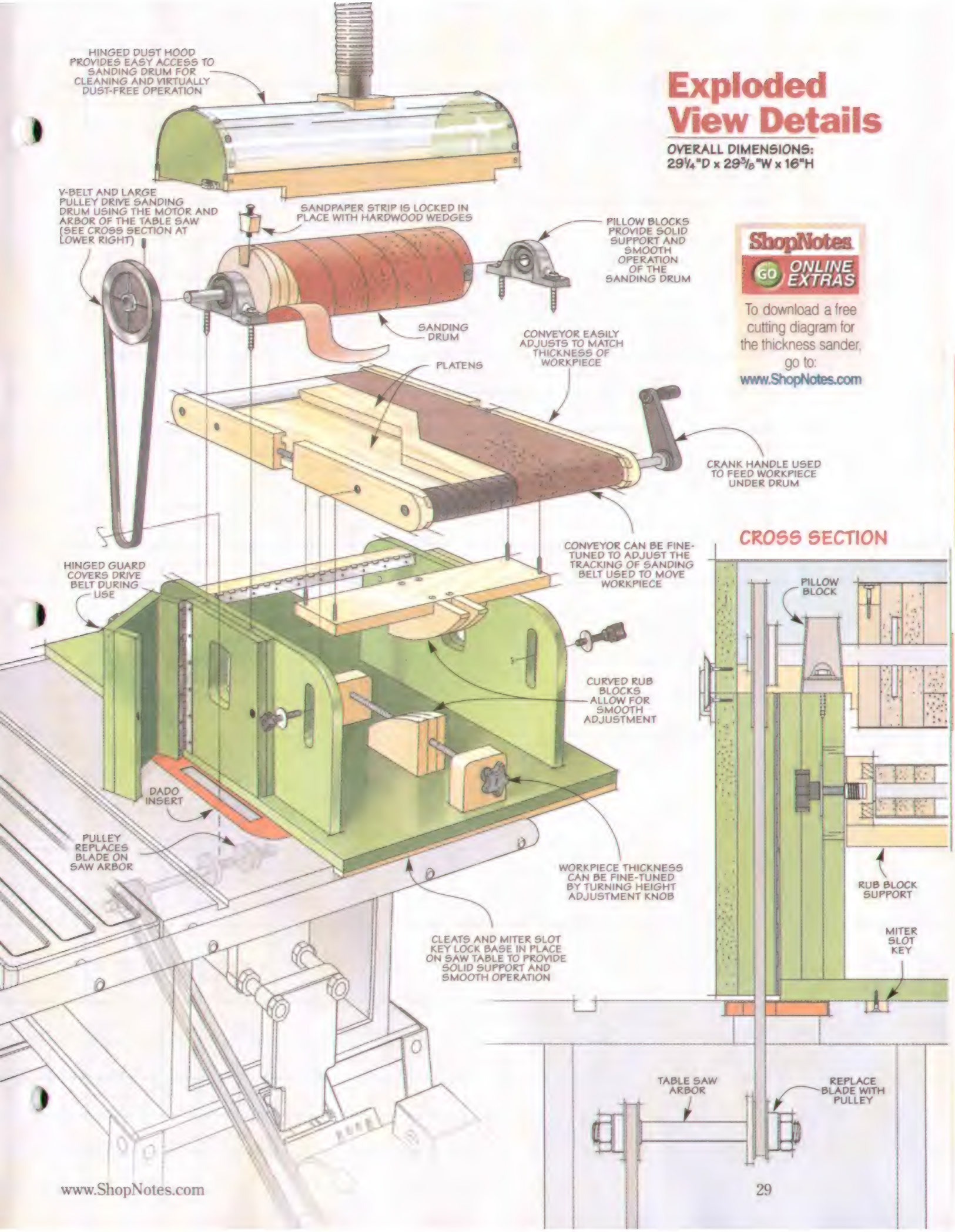
# build your own Thickness Sander

## Create perfectly flat, smooth panels up to 16" wide and the exact thickness you need.

It's not often you can save time and money — this heavy-duty, shop-built project will do both.

Many manufactured thickness sanders can cost three times as much (or more). The one shown above only costs about $200 to build — a big savings. And the time you save smoothing a panel or thicknessing a workpiece can be put to use building more projects.

Powered by the motor on your table saw, this machine can quickly sand panels up to 16" wide so they're flat and smooth — whether it's a 3"-thick workpiece or a strip of veneer only 1/16" thick. A simple handcrank feeds the workpiece through at just the right speed and you can watch the sanding dust simply disappear through the see-through dust hood.




# Exploded View Details

**OVERALL DIMENSIONS:**
**29¼"D x 29⅝"W x 16"H**

**ShopNotes**
**GO ONLINE EXTRAS**

To download a free cutting diagram for the thickness sander, go to:
www.ShopNotes.com

# building the Base

The base assembly of the thickness sander provides support for all the other parts, so that's where I started.

The base itself isn't all that complicated as you can see in Figure 1. The overall length of the ¾" MDF base depends on the size of your saw table. To determine this, measure from the front edge of the saw table to the back and then cut the base 1½" longer. Then, you can trim the base to a width of 22¾".

**Lock it In.** Once you have the base sized, the next step is to make sure it stays in one place as you're using the sander. To accomplish this, you'll need to do two things.

First, the cleats you see in Figures 1 and 1a prevent any front-to-back movement. And the side-to-side movement is stopped by a key that fits the miter slot of your table saw (Figure 1).

The trick is locating the key. If you take a look at Figure 1b, you can see where the saw blade has been replaced with a small pulley that will be used to drive the drum. The the key is screwed in place so the edge of the base is located 1" from the center of the pulley used to drive the sanding drum.

**Adding Solid Support.** With the base in position, the next step is to add a pair of beefy supports for the drum and conveyor. In Figure 1, you can see that each support is made up of a large inner panel and a pair of smaller outer panels.

**Adjustment Holes & Slots.** Once you cut the inner support panels to size, you'll need to drill a series of holes at one end. These holes provide a pivot point for the conveyor assembly so you can adjust its height to match the workpiece.

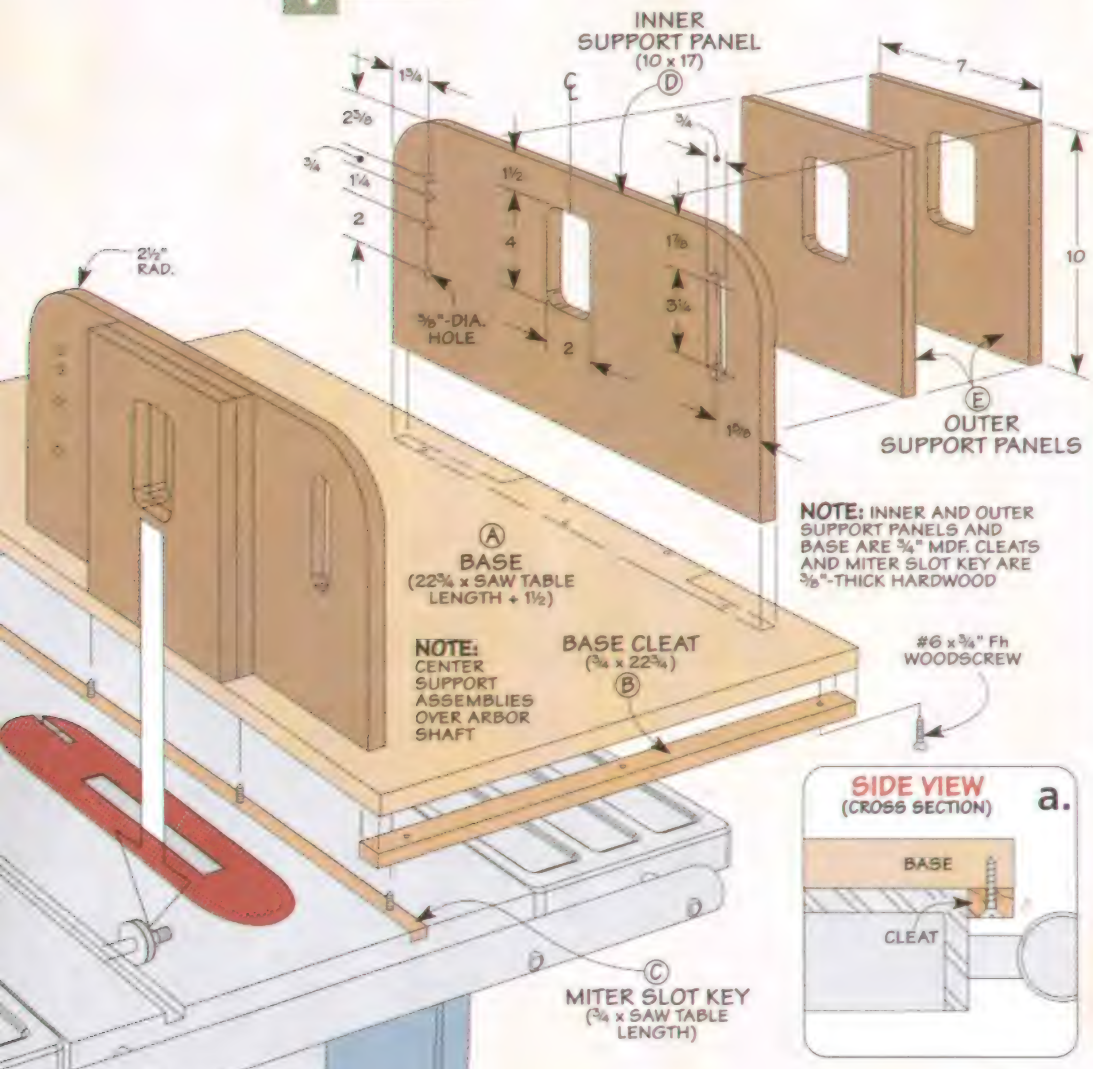
At the opposite end of the panel is a narrow slot. This slot allows the conveyor to move up and down to adjust for the thickness of the workpiece and then be locked in place.

**Outer Support Panels.** After rounding the outside corners of the inner panel, you're ready to add the outer panels. These panels are glued in place so they're centered on the inner support panel (Figure 1).

The last step in completing the support assemblies is to cut a large opening in each assembly, as shown in Figure 1. These openings provide access to a lock nut that's used to adjust the tension and tracking of the conveyor belt.

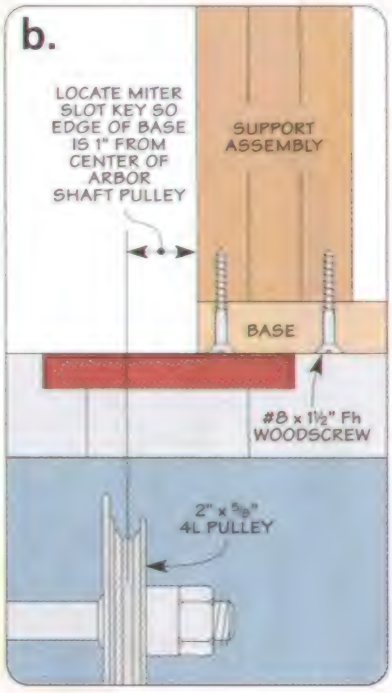
**Attach the Supports.** At this point, you can screw the support assemblies to the base. To prevent the drive belt from rubbing against the guard (installed later), it's important to align the center of the support assemblies with the arbor shaft of your table saw (Figure 1b). And each support is flush with the edges of the base.

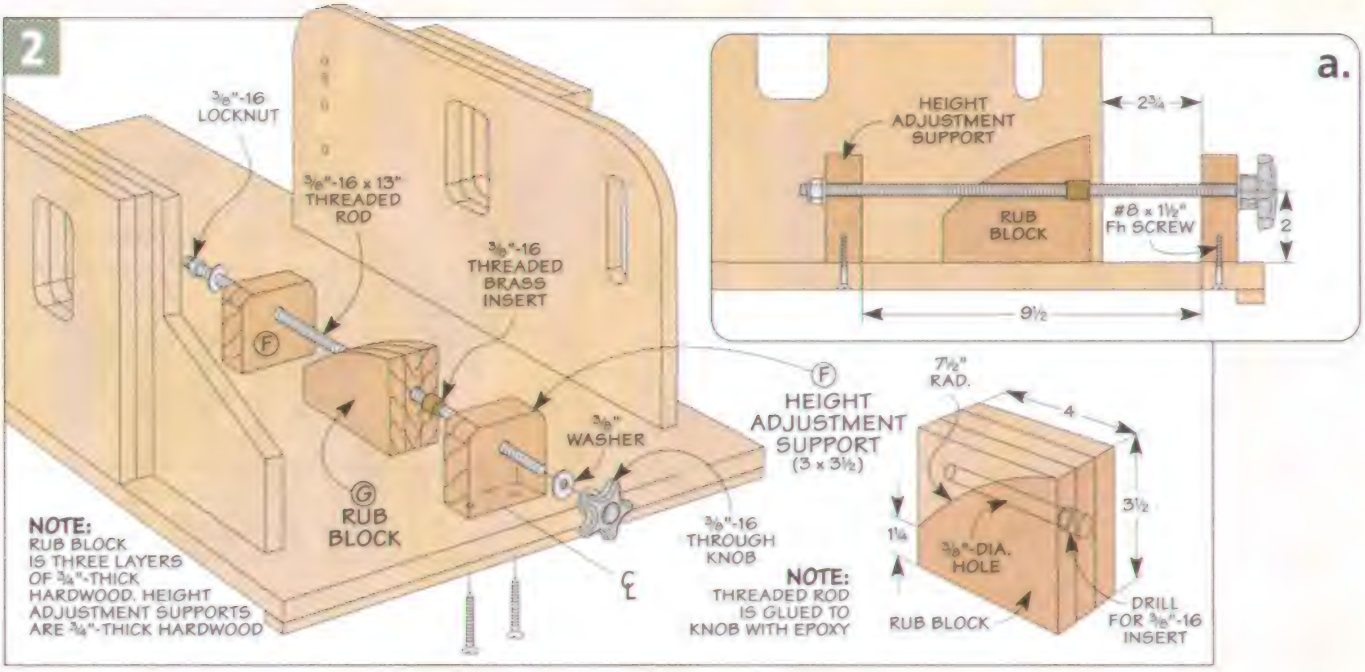
1 OVERVIEW












**Painting the Base.** If you plan to paint your thickness sander, you'll want to do that now. For more information on getting great results when painting MDF, turn to page 23.

**Adjusting the Height.** A thickness sander is only as good as the mechanism for fine-tuning the thickness of a workpiece. This height adjustment mechanism is a two-part system. One part is attached to the conveyor (more on this later), while the other half mounts to the base (Figure 2).

The main part of the system attached to the base is a 2¼"-thick hardwood rub block that's curved along the top edge, as illustrated in Figure 2. Later, this block will support a similar pair of blocks that will allow you to fine-tune the height of the conveyor.

A through hole and a counterbore for a threaded insert allows you to use a knob and threaded shaft to move the block back and forth between two hardwood mounts. This movement raises and lowers the conveyor so you can accurately thickness a workpiece.

Once you have the mounts sized and located, as in Figure 2a, you can cut the threaded shaft to length. Then, it's just a matter of gluing the knob in place with epoxy, and installing the rub block.

# Materials & Hardware

**BASE**

| | | |
|---|---|---|
| A | Base (1) | 22¾ x Custom Fit - ¾ MDF |
| B | Base Cleats (2) | ⅜ x ¾ - 22¾ |
| C | Miter Slot Key (1) | ⅜ x ¾ - Custom Length |
| D | Inner Support (2) | 10 x 17 - ¾ MDF |
| E | Outer Supports (4) | 7 x 10 - ¾ MDF |
| F | Height Adjust Supports (2) | ¾ x 3 - 3½ |
| G | Rub Block (1) | 2¼ x 3½ - 4 |

**CONVEYOR ASSEMBLY**

| | | |
|---|---|---|
| H | Roller End Plugs (12) | 1½ x 1½ - ¾ MDF |
| I | Platens (2) | 17 x 18¾ - ½ Ply. |
| J | Sides (4) | 1 x 2⅜ - 10¾ |
| K | Side Stops (8) | ⅜ x ½ - 1⅞ |
| L | Conveyor Rub Blocks (2) | ¾ x 3½ - 5½ |
| M | Rub Block Support (1) | ¾ x 3½ - 18¼ |

**SANDING DRUM**

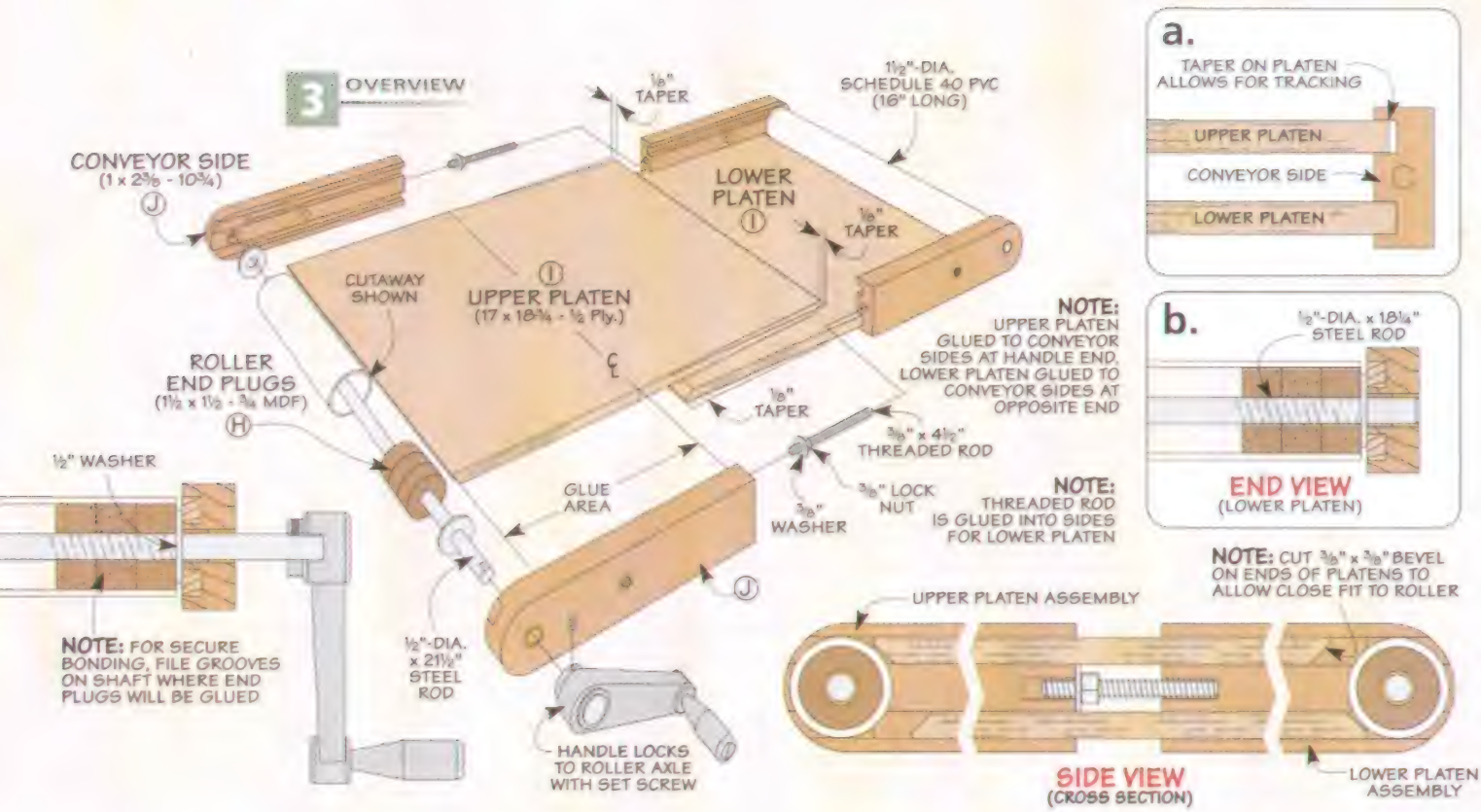
| | | |
|---|---|---|
| N | Drum Disks (19) | 5⅛-dia. rgh. - ¾ MDF |
| O | Drum Lock Disks (2) | 5⅛-dia. rgh. - ¾ MDF |
| P | End Disks (2) | 5⅛-dia. rgh. - ¾ MDF |
| Q | Lock Wedges (2) | ¾ x 1- 1⅛ |

**BELT GUARD & DUST HOOD**

| | | |
|---|---|---|
| R | Door (1) | 7 x 10⅝ - ¾ MDF |
| S | Back (1) | 15⅛ x 10⅝ - ¾ MDF |
| T | Front (1) | 1½ x 10⅝ - ¾ MDF |
| U | Dust Hood Ends (2) | 4⅞ x 6½ - ¾ MDF |
| V | Dust Hood Front/Back (2) | ⅜ x 1¾ - 25 |
| W | Hinge Support (1) | ¾ x 1½ - 18¼ |
| X | Vacuum Hose Port (1) | 3⅜ x 3⅜ - ¾ MDF |

- (28) #8 x 1½" Fh Woodscrews
- (5) ⅜"-16 Threaded Brass Inserts
- (4) ½" x ½" Bronze Sleeve Bearings
- (1) ½" x 21½" Steel Rod
- (1) ½" x 18¼" Steel Rod
- (4) ½" Flat Washers
- (3) ⅜"-16 Lock Nuts
- (8) ⅜" Flat Washers
- (2) ⅜"-16 x 4½" Threaded Rods
- (2) 1½" x 16" Schedule 40 PVC Pipes
- (1) Handle and Set Screw
- (1) 6" x 48" Sanding Belt (100-Grit)
- (4) ⅜"-16 x 2" Studded Knobs
- (2) Pillow Blocks
- (1) ¾" x 24" Steel Rod
- (2) 5/16" x 2¾" Steel Rods
- (4) 5/16" x 2½" Lag Screws
- (4) 5/16" Flat Washers
- (1) 5" x ¾" 4L Pulley
- (1) 2" x ⅝" 4L Pulley
- (1) 4L440 V-Belt (44")
- (2) ¼"-20 x 1½" Rh Machine Screws
- (2) ¼"-20 Threaded Brass Inserts
- (1) ⅜"-16 Through Knob
- (1) ⅜"-16 x 13" Threaded Rod
- (4) #8 x 1" Fh Woodscrews
- (10) #6 x ¾" Fh Woodscrews
- (1) 11⅞" x 25" Polycarbonate Sheet (0.04" Thick)
- (12) #6 Finish Washers
- (12) #6 x ⅝" Fh Woodscrews
- (1) 1½" x 10⅝" Piano Hinge w/screws
- (1) 1½" x 18" Piano Hinge w/screws
- (2) ⅜" x 1½" Fender Washers
- (1) Cloth Electrical Tape
- (2) Latches w/screws
- (1) Magnetic Catch

**Also Needed:** One sheet of ¾" MDF, one-half sheet of ½" Baltic birch plywood, and approximately 3 bd. ft. of hardwood.




# adding the Conveyor

With the base complete, the next step is to add the conveyor assembly that both supports and feeds the workpiece under the sanding drum.

The conveyor is just a pair of very similar platen and roller assemblies that slide together, as in Figure 3. This design makes it easy to slip the conveyor belt in place, but still allows you to tighten and adjust the conveyor so the belt tracks smoothly and evenly.

**Start with the Rollers.** Since the rollers have to be in place before you can glue each platen assembly together, that's where I started.

The rollers are just lengths of PVC pipe with steel rods that act as axles. It's important to note that one of the rods is a bit longer than the other. This allows for the feed handle at one end, as you can see in Figure 3.

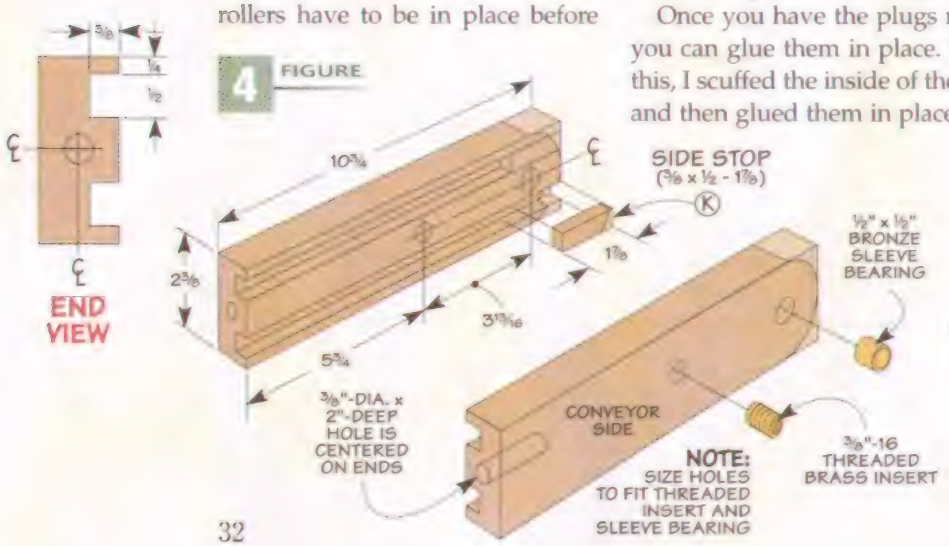
**Making the Shaft Plugs.** To support the shafts in the center of each roller, there's a set of three MDF plugs at each end (Figure 3b). I used a wing cutter to size the plugs to fit the PVC pipe and then enlarged the holes to fit the shafts. For a handy way to ensure the larger holes stay perfectly centered, turn to Shop Short Cuts on page 14.

Once you have the plugs made, you can glue them in place. To do this, I scuffed the inside of the pipe and then glued them in place with the outside plug flush with the end of the roller. (Polyurethane glue or epoxy work best here.)

**Fitting the Shafts.** The next step is to cut the two shafts to final length and install them. A slight chamfer on each end will make installing the shafts in the roller easier, but you still may find it a challenge. Shop Short Cuts shows a handy way to "press" the shafts in place. Note: To ensure the epoxy bonds the plugs securely to the shaft, it's a good idea to file some grooves in the area where the shafts mate with the plugs (Figure 3b).

**Turn to the Platens.** For right now, you can set the rollers aside and work on the rest of the conveyor parts: the two platens and the four side pieces, as illustrated in Figures 3 and 4.

The platens are just pieces of ½" Baltic birch plywood. If you look closely at Figure 3, you can see that both edges at one end of each platen are tapered slightly. Tapering these edges allows you to adjust the tracking of the conveyor belt once it's installed. And to provide a closer fit around the roller, each end of the platen is beveled, as shown in the Side View of Figure 3.



**Making the Conveyor Sides.** With the platens complete, you can turn your attention to the 1"-thick hardwood sides that provide strength and stability (Figure 4).

After cutting the sides to size, I drilled three holes in each. One hole accepts a bronze bearing that supports each end of the roller. A second hole is sized for a threaded brass insert used to mount the conveyor assembly to the base place. And the third hole is in one end of the side piece. It accepts a threaded rod used to adjust the conveyor belt (Figure 3). Here again, turn to page 14 for a handy jig to do this.

Once you have the holes drilled, the next step is to cut a pair of grooves in each piece (Figure 4). These grooves capture the edges of the platen and allow the two assemblies to slide together.

Then to locate the platens as you slide them into the sides, I added a pair of stops to each side piece (Figure 4). Once the stops are glued in place, you can round the end of each side piece and glue the threaded rod in place in *two* of the side pieces (Figures 3 and 3a).

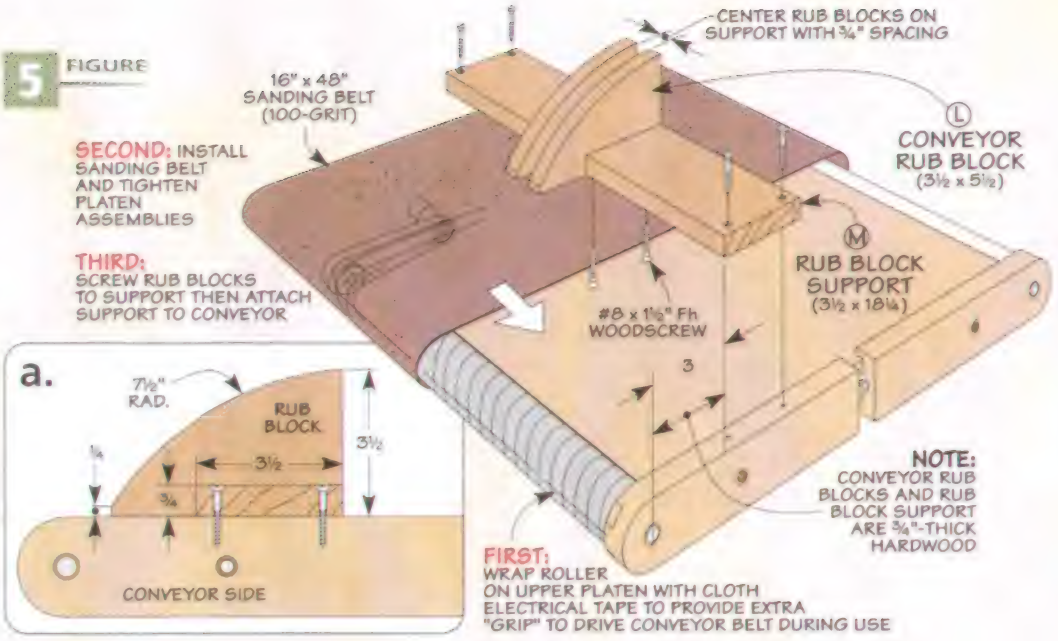
**Assemble the Conveyor.** At this point, you're ready to assemble the conveyor. And you'll want to be sure to pay close attention as you do this. It can be easy to glue the wrong parts in place since everything looks alike. To help out here, I labeled one set of parts as the "upper platen" (uses the longer shaft) and the other as the "lower platen" (uses the two side pieces with the threaded shafts).

One thing to keep in mind is that it's the straight edges of the platen that are glued to the side pieces. The tapered edges aren't glued at all. Finally, putting the two assemblies together during assembly ensures that everything will stay nice and square while the glue dries.

**Conveyor Height Adjustment.** After you install the handle on the upper platen and slip the belt in place, you're ready to add the other half of the height adjustment mechanism. This is nothing more than a pair of rub blocks and a support piece that align with the rub block on the base (Figures 5 and 5a). The space between the blocks provides clearance for the threaded shaft on the base.

Once you have everything in place, you can install the conveyor and then adjust the belt tracking. For more on this, check out the box below.

FIGURE 5

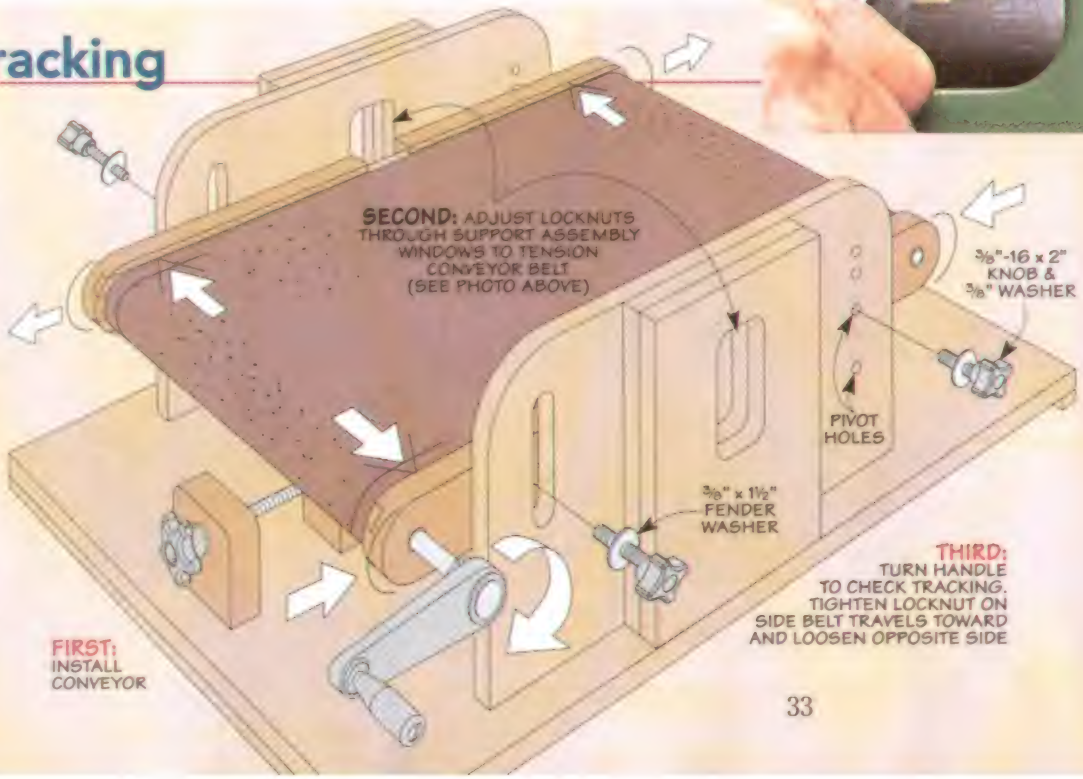


## Adjusting the Tracking

A set of knobs and washers is all it takes to install the conveyor. (To adjust the tracking, it doesn't matter which set of pivot holes you use.)

**Adjusting the Tracking.** For the sanding belt to track evenly, you'll need to "tweak" the tension on the belt. This is just a matter of tightening (or loosening) the adjustment nuts (photo at right).

Start by turning the handle and noting which side the belt moves toward. Next, slightly tighten the nut on that side (you may need to slightly loosen the opposite side as well.) Check the tracking again, and repeat until it tracks evenly.



# making the Drum

With the conveyor assembly in place to support and move the workpiece, the next step is to make the sanding drum.

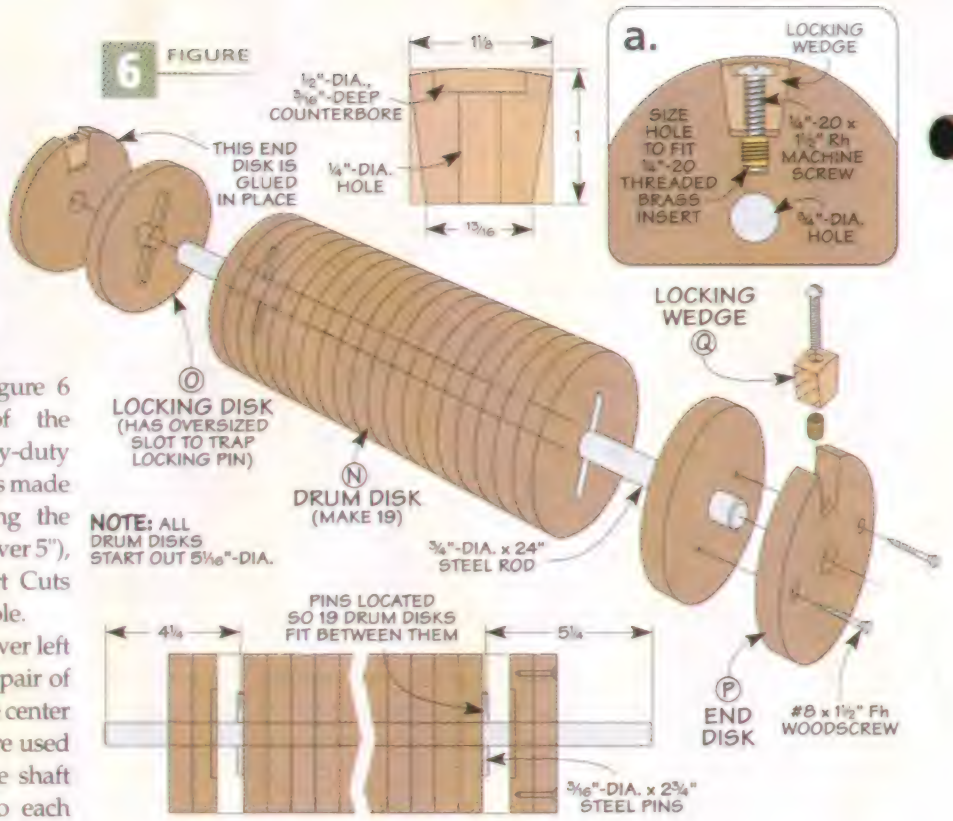
**Start with the Disks.** Figure 6 provides an overview of the sanding drum. It's just a heavy-duty steel shaft and a set of 23 disks made from ¾" MDF. After cutting the disks to rough size (slightly over 5"), you can turn to Shop Short Cuts again to enlarge the center hole.

If you take a look at the lower left part of Figure 6, you'll see a pair of steel pins on either side of the center disks (19 total). These pins are used to "lock" all the disks to the shaft once the disks are glued to each other (Figure 6a). It is important to locate the pins so that 19 of the disks fit between them once they're installed and glued together.

Slipping the disks in place for assembly can be a challenge if the fit is really tight. Shop Short Cuts on page 14 shows how an easy way to "press" the disks in place.

**Adding the Locking Disks.** With the center section of the drum assembled and the pins in place, you're ready to glue on the locking disks that keep the entire assembly from spinning. To do this, each locking disk has a slot that traps the locking pin (Figure 6).

FIGURE 6



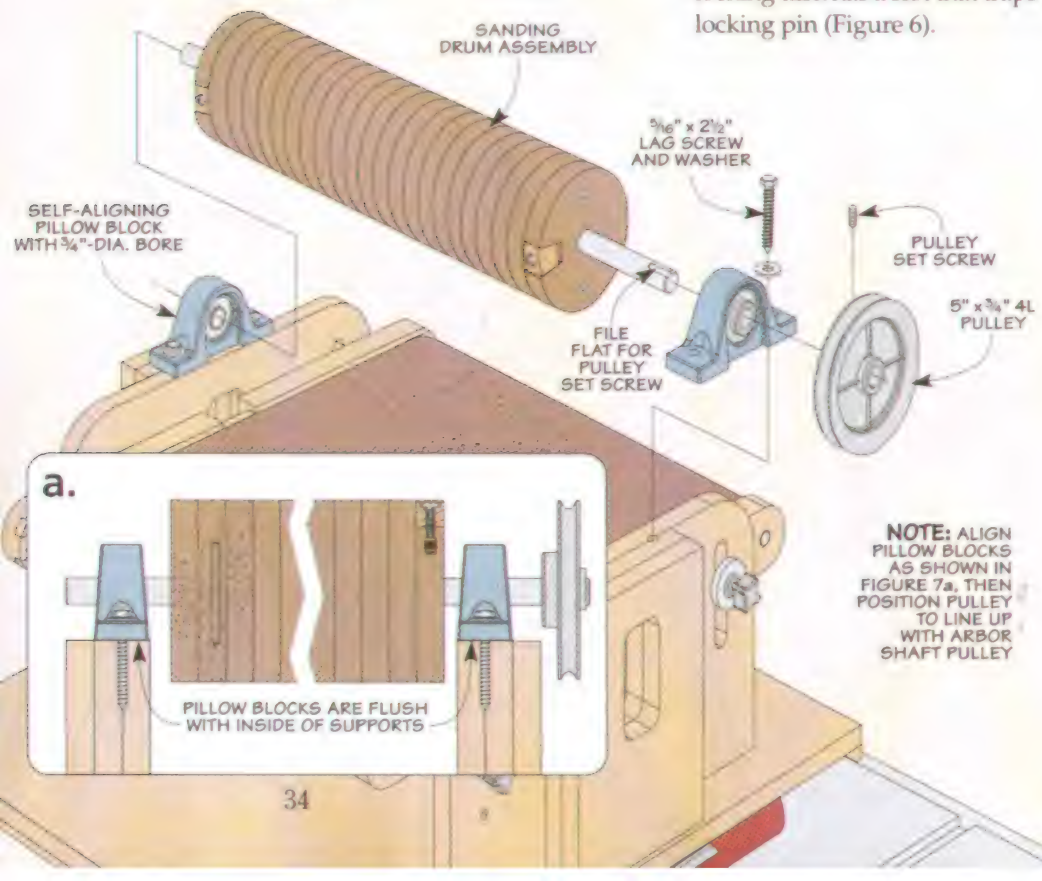

**Complete the Ends.** The next step is attaching the two end disks. The end disks serve an important function — they hold the sandpaper in place on the drum. To do this, each disk has a tapered notch cut in it to accept a hardwood wedge, as in Figure 6a.

A threaded insert installed at the bottom of the notch accepts a machine screw that passes through the wedge. (For more on drilling the hole for the threaded insert, turn to page 14.) Tightening the wedge "pulls" the sandpaper tight around the drum and locks it in place.

As you can see in Figure 6 above, the end disk at the far end of the shaft is glued to the rest of the drum. At the other end, the disk is screwed in place. The reason for this is simple — the end of the sanding strip needs to fit into the notch. Screwing the disk to the rest of the drum allows you to reposition it to match the trued up drum (more on this later).

**Install the Drum.** The next step is to install the drum. To do this, start by slipping a pillow block onto each end of the shaft. But don't tighten the set screw to lock them in place just yet. First, set the

FIGURE 7



assembly on top of the base supports so the pillow blocks are centered over the arbor shaft and align with the inside face of the uprights, as in Figure 7a.

The pillow blocks are self-aligning, but you may have to "tweak" each one a bit so it rests flat against the top of the support. Then you can drill the mounting holes and screw the blocks in place.

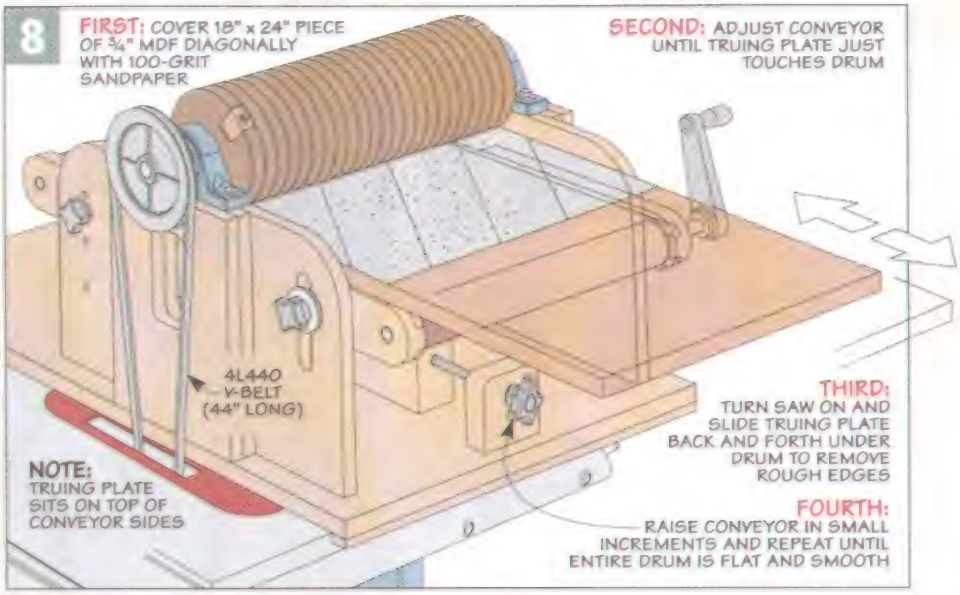
After filing a small flat at the end of the shaft, you can install the pulley and belt that drives the drum (Figures 7 and 8). Note: To tighten the belt, simply lower the saw arbor.

**Truing up the Drum.** Figure 8 shows you how I used a flat sheet of ¾" MDF covered in 100-grit sandpaper to true up the sanding drum. Note: Although you can true the drum up at this point, you may want to wait until the dust hood is installed to cut down on the sanding dust (turn to page 36).

After covering the sheet with sandpaper, raise the conveyor until the sanding sheet just touches the drum. Then, turn your table saw on to start the drum spinning and slide the truing plate under the drum.

You'll need to raise the conveyor in small increments as you work, replacing the sandpaper as necessary. And don't worry about the final size of the drum. What's more important is that it's smooth, flat, and true to the conveyor.

Once the drum is trued up, it's a good idea to apply a couple coats of finish to "harden" the surface. Then you can check out the box below for installing a strip of sandpaper.



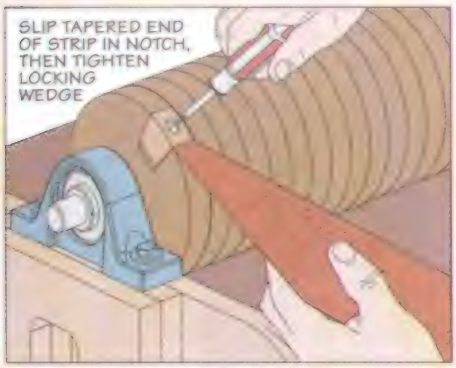

## Install a Sanding Strip

Installing the first sanding strip determines the position of the end disk you screwed in place earlier. Plus, it creates a handy template for any other sanding strip.

**Taper One End.** The first step is to taper one end of a 3"-wide sanding strip (drawing at right). Once that's complete, lock the end in place (left drawing below.)

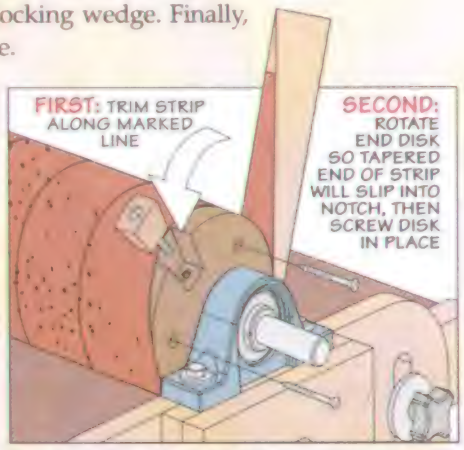
**Wrap the Drum.** Next, wrap the strip around the drum making sure the edges butt against one another. With the strip held in place, use a pencil to trace along the inside of the strip where it rolls off the end of the sanding drum (center drawing). Note: You may need to make small adjustments to the taper at either end slightly to match the final diameter of the drum.

**Locate the End Disk.** Next, trim along the pencil line and clip off the tip. Now, loosen the locking wedge and rotate the end disk until the end of the strip will slip in place, then tighten the locking wedge. Finally, screw the end disk back in place.




▲ ***Starting the Strip.*** *After tapering one end of the sanding strip, lock it in place with the wedge and wrap it around the drum.*

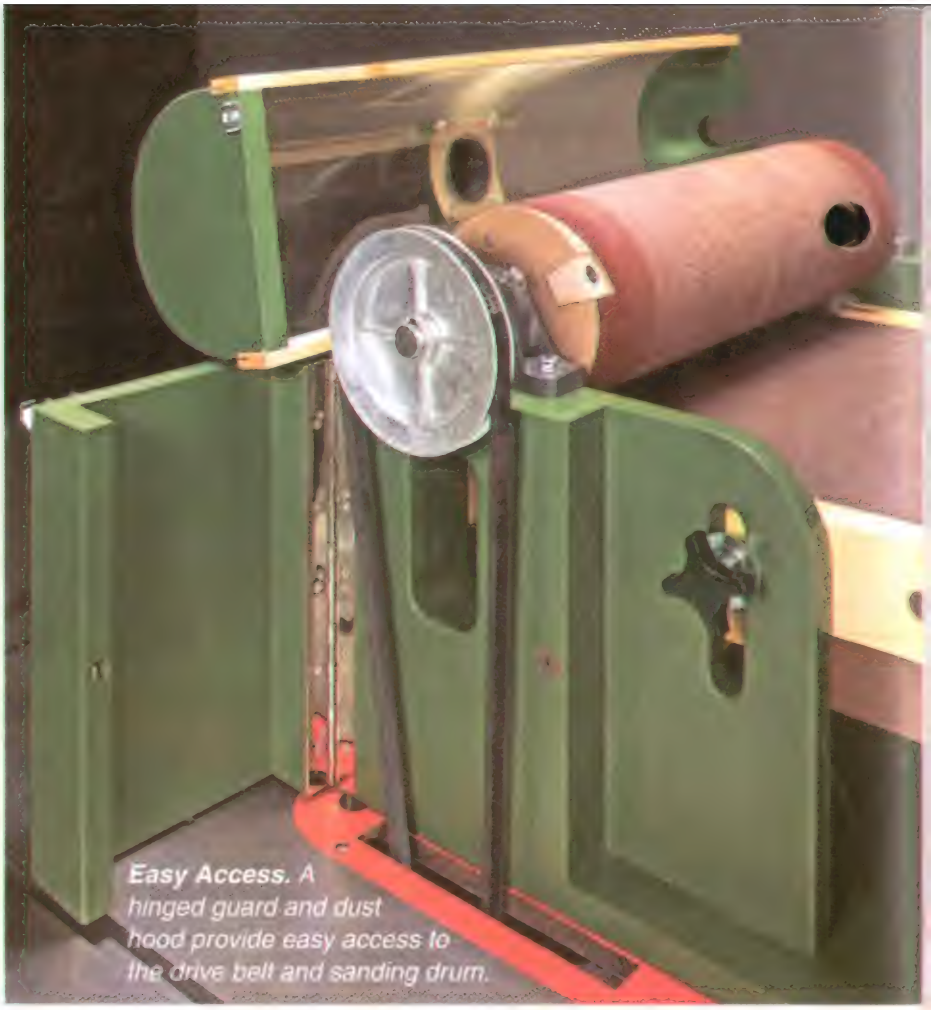
▲ ***Mark the Strip.*** *At the opposite end of the drum, mark where the strip goes off the end of the drum. Then trim along the line.*




▲ ***Locate the End Disk.*** *Rotate the end disk until the tapered end of the strip fits into the notch, then screw the disk in place.*

finish up with the

# Belt Guard & Dust Hood



**Easy Access.** A hinged guard and dust hood provide easy access to the drive belt and sanding drum.

You're almost done with the thickness sander. All that's left to do is add a belt guard and dust hood, like the ones in the photo at right.

## BELT GUARD

The size of the dust hood depends on the final size of the belt guard, so I built the guard first.

**A Simple Door.** Making the belt guard will go pretty quick. It's really nothing more than three pieces of ¾" MDF joined together in the shape of a "U" to wrap around the belt and pulley (Figure 9a).

To allow for the piano hinge used to mount the guard, the back is slightly narrower than the front. Then, to ensure the guard doesn't rub, it's raised slightly above the saw table (Figure 9). And a magnetic catch holds the guard closed, even if the dust hood is open.

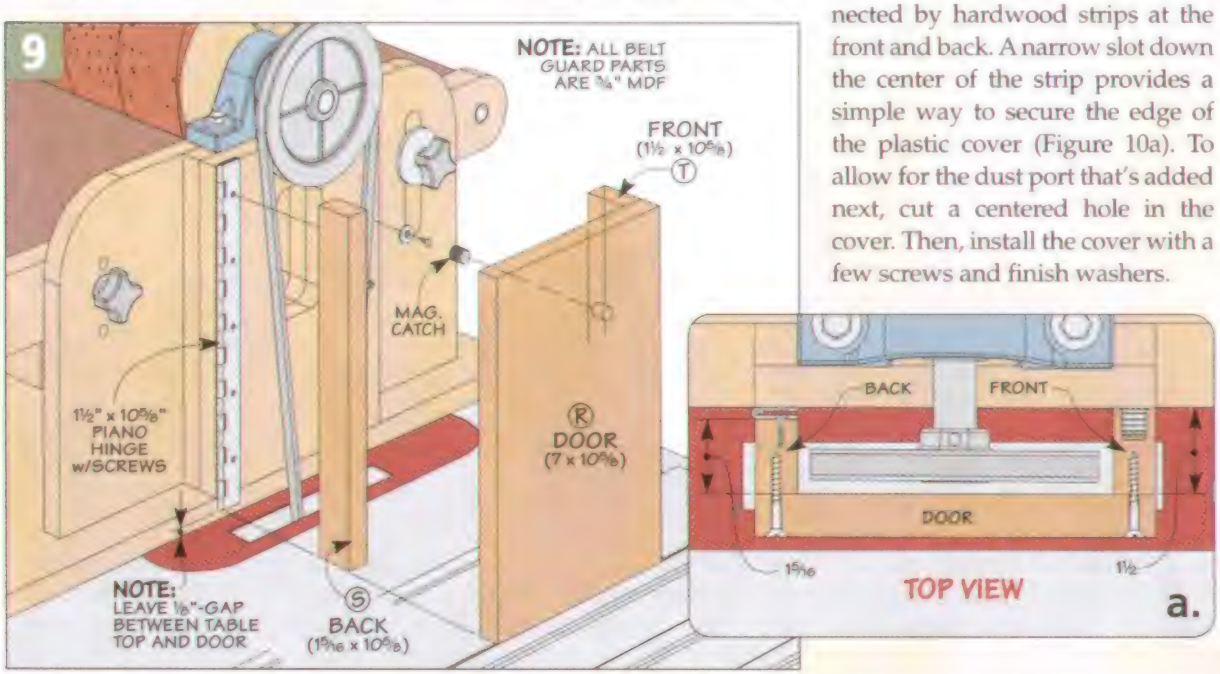
## CONTROLLING THE DUST

A thickness sander can make a lot of dust in a hurry. So a dust collection hood is pretty much a necessity.

The dust hood doesn't require much in parts or time to make. It's just two ends connected by hardwood strips at the front and back that hold a clear, plastic cover in place (Figure 10). And a dust port at the top allows you to hook up the hose from your shop vacuum.

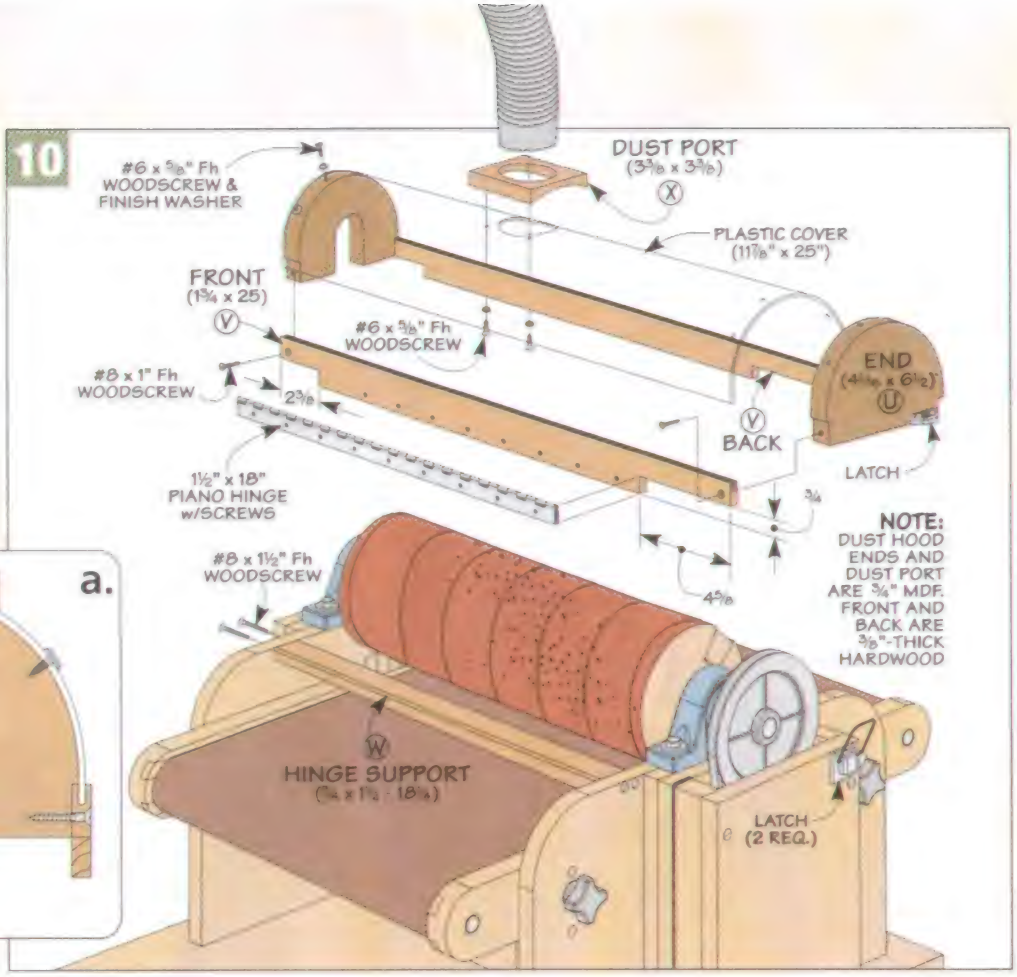
**Make the Ends.** I started by making the ends of the dust hood from ¾" MDF. After notching the ends to accept the front and back strips, you can round the ends and notch one of them to fit over the shaft of the drum (Figure 10).

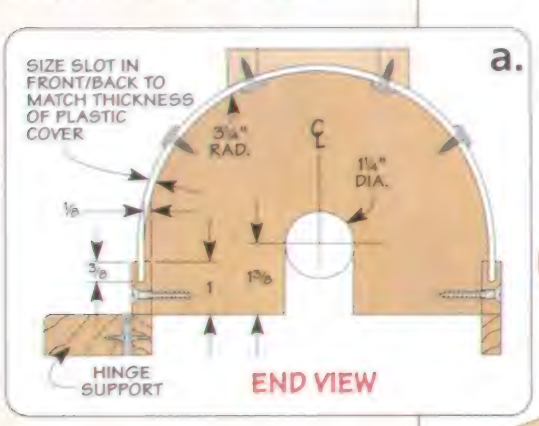
**Assembly.** The ends are connected by hardwood strips at the front and back. A narrow slot down the center of the strip provides a simple way to secure the edge of the plastic cover (Figure 10a). To allow for the dust port that's added next, cut a centered hole in the cover. Then, install the cover with a few screws and finish washers.



**Installation.** After sizing the dust port and screwing it to the cover, you're ready to attach the dust hood to the base using a piano hinge and a hinge support bar (Figure 10). Finally, add a pair of latches to hold the dust hood closed.

With all the work behind you, you're ready to put your thickness sander to work. For a few tips on setting up and using the sander, check out the box below.




## Sander Set Up: Step by Step

With the sander complete, you'll find using it is the easiest part of all.

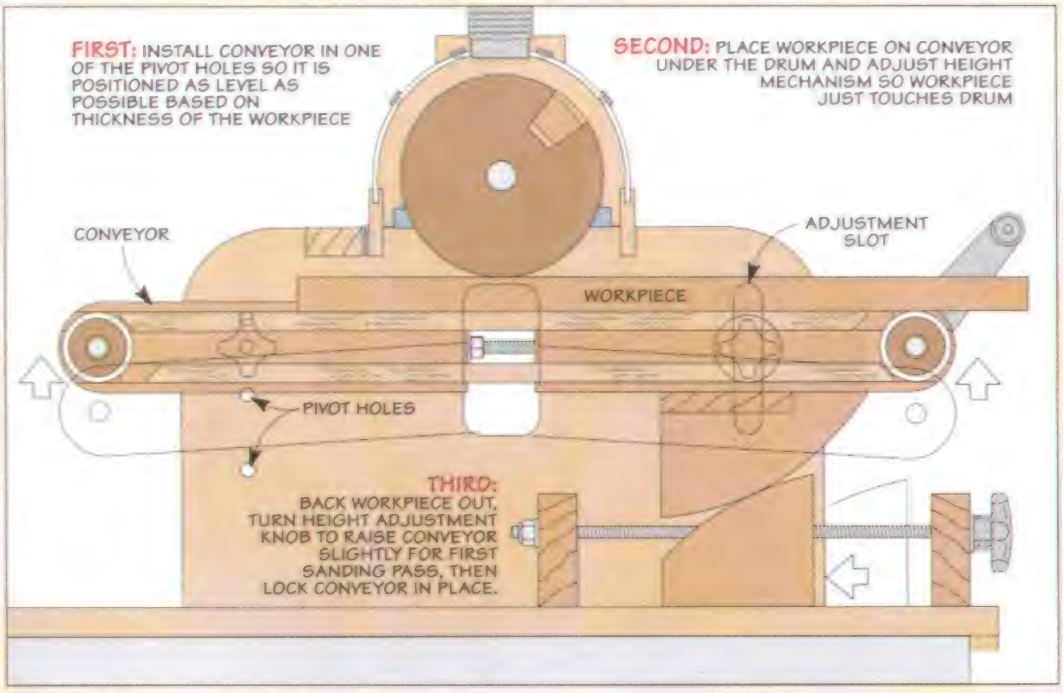
**Sandpaper Grit.** The first thing to do is install a strip of sandpaper suited to the task at hand. For taking a workpiece down in thickness, you can use 50- to 80-grit. For finish sanding, I like to use either 150- or 180-grit sandpaper.

**Adjust the Conveyor.** Once you have the sandpaper installed, the first step in using the sander is establishing the initial location of the conveyor. It should be as level as possible when the workpiece is just touching the drum (drawing at right). You'll need to adjust the rub block so it supports the conveyor in this position.

After backing out the workpiece, give the height adjustment knob a small turn to provide some initial sanding and then lock the conveyor in place.

With your sander running, turn the handle at a constant rate to smoothly move the workpiece under the drum. For subsequent passes, simply raise the conveyor slightly and repeat the process.

Once you have one side flat and smooth, it's a good idea to flip the workpiece over between passes, just like you would when using a power planer. And to get the best results, it's always a good idea to clean the sanding drum often.



# what's new in PVA Glue

When it comes to "yellow glue," woodworkers now have a lot of choices.

When you hear a woodworker talk about using glue, it's a pretty good bet they mean PVA (polyvinyl acetate) glue. This is the common yellow (or white) glue that most of us rely on for ninety percent or more of our gluing chores. For most woodworking applications, it just can't be beat.

But in recent years, new types of PVA glue have been showing up that make it even more useful and versatile. And I won't argue with making a good thing even better.

## Slow-Set Glue

Complex glueups, involving lots of parts and lots of clamps, can be tough and stressful. The challenge is to get the glue spread, the joints assembled, and the clamps in place and tightened down before the glue starts to tack up and "grab."

Most yellow glues only give you about five to ten minutes "open time" to get all this accomplished. And often this isn't enough. The new, slower-setting *Extend* PVA glue, shown at right, offers you a fighting chance. Its slightly longer open time gives you a few extra minutes to get the job done (photo above).

## Gap-Filling Glue

***A Tighter Joint.*** *Box joints or dovetails assembled with gap-filling PVA glue might look a little better.*

Gap-filling PVA glue needs a little explanation. It might not be quite what you think it is. You don't want to think of so-called "gap-filling" PVA glue as a cure for poor-fitting joinery. But where it does have a place is in making your joinery look better and saving you some time.

The fact is that most PVA glues are more than half water. When the water evaporates and the glue cures, what's left are the bonding resins and fillers. The key to gap-filling glues is that they contain a little less water and have a slightly higher solid content. What this means is that these glues shrink a little less when they dry.

This feature can come in handy when gluing up exposed joinery like dovetails or box joints (photo at left). The extra volume left after the glue dries acts like a filler to help close the inevitable small gaps in the joinery. But remember, it's just for looks, not strength.

## Molding Glue

If you've ever carefully applied PVA glue to a vertical surface, as when attaching trim to a case, only to watch it run down the side and make a mess, you might want to give molding glue a try. Molding and trim glue is specially formulated to stay right where it's applied, until you want it to spread out. A look at the photo below gives you the idea.

The fancy term for the property at work here is *thixotropy*. What this means is that when the glue is "at rest," it's thick and gummy. But as soon as it gets stirred up, as when two pieces are pressed together, it becomes fluid and spreads out just like standard PVA glue. The result is a snug-fitting joint, without the extra aggravation and time spent cleaning up.

**It Stays Put.** *The upper bead of molding glue doesn't run and drip like the standard yellow glue.*

## Dark PVA Glue

You know that wood comes in lots of different colors. But until recently, PVA glue was only available in white or yellow. But now you have another option.

Dark wood glue, as you might guess, is meant for use with dark-colored woods such as walnut or mahogany, or even when a dark stain is going to be applied to a project. As you can see in the photo below, the medium-brown color of the dark glue is a little closer match to the color of the walnut board.

When I do a glueup, I try to make sure the glue is limited to the inside of the joint and doesn't show on the surface. But if you want a little insurance against light-colored glue showing up against dark wood, this new glue might be the answer.

**Matching Colors.** *The idea is simple. The dark glue is a closer color match to the wood.*

## Stainable Glue

You complete building a project, carefully sand your hard work and then begin applying the stain. Only then does the glue left in a corner or along a joint line come to light. The stain won't penetrate and the spot sticks out like a sore thumb.

Stainable PVA glue is an attempt to hide this common problem. The trick here is that the glue has wood fibers mixed in with it. The wood fibers absorb some stain, so you're actually staining the glue, not the wood beneath it. As you can see at right, the wood fibers make the stainable glue (lower) darker to begin with. And then it does stain a little darker yet. But honestly, I wouldn't rely on stainable glue as a cure for sloppy cleanup.

► ***Wood in the Glue?*** *When you apply this glue, you'll notice that it looks a little "gritty" due to the wood fibers that are mixed in.*

## Fluorescent Glue

When you mention fluorescent PVA glue to a woodworker, the most common reaction is a blank look. But after thinking about it for a minute, the idea behind it clicks.

Fluorescent PVA glue has a harmless dye added to the mix that causes it to "glow" when exposed to ultraviolet (black) light, as you see in the photo below. Other than this unique feature, it's just standard PVA glue.

The problem this "glow-in-the-dark" glue aims to solve is a common one — finding all the squeeze-out and stray spots of glue that may go unnoticed during or after the assembly of a project. You just turn the lights down, pass a UV light (mine is battery-powered) over the project and even "invisible" spots of glue will show up.

**"Glow in the Dark" Glue.** *Unwanted spots of glue can't hide under ultraviolet light.*

## table saw upgrade

# Outfeed Support

## A stand (or two) offers a helping hand for working with large workpieces.

Cutting large plywood panels or long boards on the table saw by myself can be a real challenge. But you can get a helping hand by adding a support stand or two to carry the load.

These benefits aren't limited to the table saw only. You can use support stands with other tools around your shop. Mine are often used with the drill press, jointer, and even miter saw. Here's a look at a few of the stands available and how to choose one for your shop.

**Roller Stands.** The most common type of stands are roller stands. They consist of a single, wide roller mounted on a base. What makes these stands so attractive — and popular — is that they're inexpensive. You can find them for as little as $12.

**Drawbacks.** But I've found a couple problems when using roller stands. The biggest issue is that unless the roller is perfectly square to the rip fence on my table saw, it can pull the workpiece to one side. If it pulls the board away from the fence, it can bind against the blade and cause burning or kickback.

Another problem I've encountered is that the height of the roller has to be set pretty accurately. If not, a board coming off the saw can hit the front of the roller and jam the cut. Or the stand may just fold up and fall over.

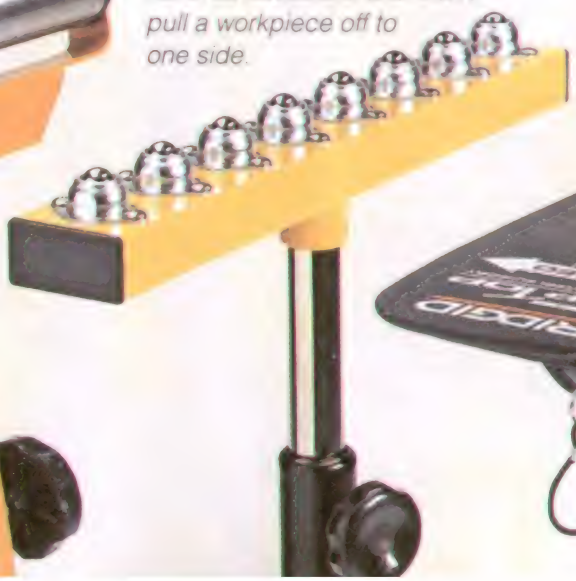
**Bearing Stands.** A second type of support stand that you'll come across is a ball-bearing stand. These stands use multiple ball bearings instead of a single roller. Since the bearings can roll in any direction, the angle of the stand doesn't have any influence on the workpiece.

You can use a bearing stand in all the same ways that you would use a roller stand. In fact, the bearing stand lets you do a few things that a roller stand can't. One place a bearing stand comes in handy is side support on the table saw. Here, you can position the head of the stand so it's parallel to the blade. This way, you can support long boards or wide panels for cross cutting.

This doesn't mean that bearing stands aren't without fault. One downside to these stands is the space between the bearings. When ripping boards on the table saw, narrow parts or waste pieces can get wedged between the bearings.

**Flat Stands.** The last type of stand is what I'd call a back-to-basics stand. These stands avoid any problems caused by rollers and bearings by using a smooth, flat top instead. One of the things I like about the flat top stands is the amount of surface area that's in contact with the workpiece.

▲ *Roller Stand. This inexpensive stand will handle most work in your shop.*



▼ *Bearing Stand. Ball bearings roll in all directions and won't pull a workpiece off to one side.*

◀ *Flat Top. A large, flat surface provides plenty of support for working with most tools in your shop.*

In the photo on the opposite page you'll see how one model of flat stand can accommodate a sagging workpiece. The *Ridgid Flip Top* stand has a pivoting top (inset photo). With the surface tilted toward the saw, it'll catch a drooping workpiece. Then the top flips to horizontal to support the piece during the rest of the cut. The top can be locked flat for when you don't need this feature.

***Tapered Upright.*** *The Rockler Flip Top won't slip during a cut because the upright wedges against the clamp.*

## HEIGHT ADJUSTMENT

There's more to support stands than what you see on top. Before you buy a stand, you'll want to look at some other qualities as well.

**Range.** Having a stand doesn't do any good if you can't adjust it to the proper height. So that's the next thing you'll want to look at.

This seems simple enough — the stand should be able to go up and down to accommodate a variety of tools in your shop. That's true, but the way stands do that can vary.

The first thing to check is whether the stand will work for all the tools you need it to. Trust me, there's nothing more frustrating than setting up the support stand and finding out it's too short to use for the drill press.

A second thing to check out is the clamp. It goes without saying that it should hold the top securely in place. One stand, the *Rockler Flip Top* stand (photo above) even has two clamps to provide an added measure of security.

**Square is Better.** One other thing about the height adjustment that deserves a look is the shape of the upright. The upright slides up and down inside the post in the stand's base. The upright post will either be round or square. Although the difference doesn't sound like a big deal, it can be. The problem is that round uprights can pivot in the post during use.

The *Rockler Flip Top* goes a step further than a ordinary square upright sliding in a square post. Instead, the upright is tapered from top to bottom. You can see this in the photo above. The main job of this design is to prevent the post from slipping down in the middle of a cut.

As a side benefit, it makes it easy to fine-tune the setting of a support stand. To do that, start by setting the stand a little higher than you need. Then slowly back off on the clamp. The upright will slide down until it's at the proper height.

In the margin, you'll see a method I use to quickly set up a stand for different tools that eliminates the guesswork.

While all the work a stand does takes place on the top, you still want to make sure the base will handle the load. And on the next page, I show you what to look for.

▲ ***Fast Setup.*** *To quickly set the height of the stand, mark the upright for the height of the different tools in your shop.*

# Clamp-On Stock Support

Most support stands are made to set on the floor near the tool you are using. But sometimes, that setup just doesn't work. For these situations, you might want to consider the clamp-on roller stands from *Rockler*.

Instead of a stand, the roller upright is connected to a two-way clamp. This means you can create a support stand whenever you need one out of almost any workbench, shop cart, or saw horse.

A pair of wing nuts under the roller allows you to offset the position of the roller to either side. The height of the stand can be adjusted up to 11". And it has a 90 lb. capacity per roller.

▲ *Cross Base.* All four feet on this base are threaded to level the stand. Not as stable as other designs.

▲ *Light Weight.* Because the legs are closer together, this stand is a little unstable in use.

▲ *Heavy-Duty.* The wide stand of the legs means this stand won't tip over. And it can support more than 400 lbs.

◀ *Stable Base.* A wide stance and rubber-tipped feet give this stand sure footing in the shop. One foot is adjustable for uneven floors.

▲ *Levelers.* The eccentric feet allow you to adjust them so the stand sits flat on the floor.

## STAND OPTIONS

After taking a look at the top of the stand and its height adjustment mechanism, there's just one more thing left to check out. And that's the base. This is where the rubber meets the road, literally. What you want is a base that can support a lot of weight and will stay put without sliding.

**Wide Stance.** For me, the most important thing about the base is a wide stance. As the two legs of the stand come down to form the four feet, the space between the feet should be pretty wide. Some stands have bases that are narrow at the bottom. The problem is narrow feet make the stand more likely to tip over. This is especially true when the stand is raised to its full height like at the drill press. I like to look for feet that are at least as wide as the top of the stand.

**Folding Stand.** Another thing I look for on a base is whether it folds up. The whole idea behind support stands is that they shouldn't take up a lot of floor space when you don't need them.

In the photos above and at right, you can see that most of the stands do fold away. The one shown at far left above doesn't fold. And while the cross base doesn't take up much room, the outstretched legs can be a nuisance.

I mentioned before that I like to have a stand that folds up for easy storage. But sometimes a stand can fold up too easily. For example, if a board sags a little as it comes off the saw table and hits the stand, you want to make sure the stand will stay in place and not fold up and crash to the floor.

**Uneven Floors.** And speaking of the feet — there's one other feature you may want to consider. And that's a leg leveler. Not every stand comes with a way to keep the top parallel with the tool you're using.

Shop floors are rarely level, so having some way to compensate for uneven floors will help make the stand work better.

In the photo above, you can see a few ways that stands account for uneven floors. One way to do that is to have all the feet threaded like the cross base shown at far left.

A second way of having all four feet adjust is shown in the left inset photo. Here, the plastic feet pads are mounted to the legs off center. The result is you can adjust the foot simply by rotating the foot pad.

*Easy Storage.* A folding design can save space in a small shop.

The ability to adjust all four feet is great, but really, all you need to do is adjust one. And that's what is shown in the stand on the far right. As you can see, just the one foot is threaded to take the wobble out.

Unfortunately, there's no perfect stand. But on the next page, you'll see two stands that offer some extra features in a single design. And, to learn where to find the support stands that are shown here, you can turn to page 51.

# Combination Outfeed Supports

A couple tool makers figure that no one stand can do it all. So they built a pair of support stands that mix the best characteristics of several types of stand designs into one. The results are feature-packed helpers that are worth taking a look at.

**Flip Top Stand.** The first is the *Rockler Flip Top* stand. This stand is both a conventional roller stand and a bearing stand. As you can see in the photos at right, the bearings are mounted on a flip-down assembly. So when you need to use the roller underneath, it just takes a few seconds to expose it.

An additional benefit is the bearing assembly acts as a ramp to "catch" drooping boards and guide them onto the main roller.

As you might expect, this stand costs more than a typical roller or bearing stand. You can purchase one for about $75 (see page 51).

**Ultimate Roller Stand.** The designers at *Veritas* pulled out all the stops in trying to pack as many features as possible on their stand. The result is the *Ultimate Roller Stand*. You can see some of the stand's features in the photo below.

The heart of this stand is a set of eight swivel casters that support the workpiece. These soft, rubber wheels won't affect the direction of the piece as it moves. In front of the casters is a steel ramp that can be adjusted to direct boards onto the wheels. You can also set the ramp to be used as a flat top stand.

Besides the casters, what sets this stand apart is its adjustability. A knob under the casters allows you to fine-tune the angle of the top. In addition to a leveling foot, this helps keep this stand parallel with the tool.

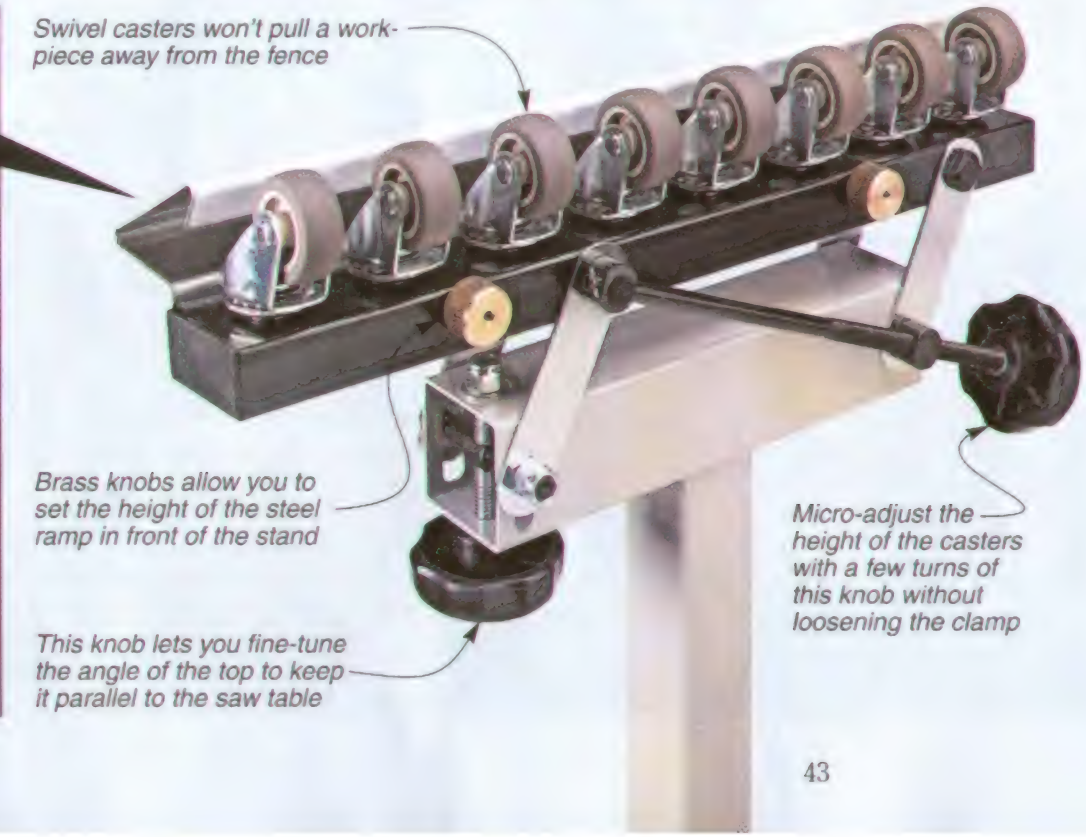
Another knob on the opposite side of the casters allows you to micro-adjust the height of the casters. This way, you only need to set the main clamp close to the height you need. Then you can dial in exact height without loosening the main clamp.

The *Ultimate Roller Stand* has a matching price (about $90).

◀ *Ramp & Roller. This stand acts as both a bearing stand and a roller stand with just a flip of the top assembly.*

▲ *Roller. Flip the bearings down to expose the roller. The bearing assembly acts as a ramp for the workpiece.*

*Ramp. Set the ramp low to catch drooping boards. Or, set it high to act like a flat top stand.*



# never-fail Splined Miters

Strengthen your miter joints with this easy table saw technique.

***The Finished Look.*** *A spline not only adds strength, but it can give a miter joint some "finely crafted" detail.*

Tightly mitered corners on a box or case look great. But unfortunately, when it comes to assembly, miter joints have a couple drawbacks. First, keeping the mitered faces aligned during the glueup can be difficult. And even if you succeed here, the porous end grain of the miters makes for a pretty weak glue joint.

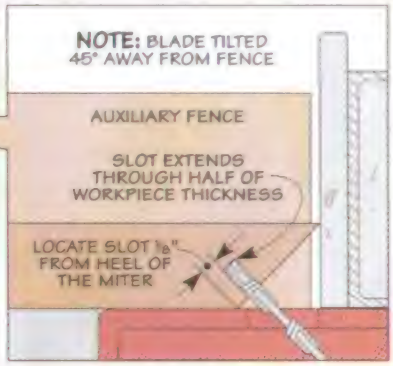
Well, a good solution for both of these problems is to add a spline across the miter joint. A spline that's only as wide as a saw kerf can keep the miters perfectly aligned during assembly. And it adds both mechanical and gluing strength to the joint (right photo).

**Two Steps.** Cutting miters on the workpieces is where you start the job. Once this is done, there are two steps on the table saw to adding a spline to the joint. The first is to cut a pair of matching slots in the mitered faces. The second is to make a spline that fits the slots and connects the two halves of the joint.

## THE SLOTS

Before I talk about cutting the slots, take a quick look at the drawing directly below. Here, you'll see not only how the slot is cut but also where to place the groove and how deep to make it.

***Cutting Slots.*** *The miter gauge is used to feed the workpiece. The tip of the miter slides along the rip fence.*




I place the groove in the "heel" of the miter — about ⅛" from the edge in ¾"-thick stock. This is the thickest part of the mitered face and it allows you to cut a deep slot and use a wide spline. But a good rule of thumb is to not extend the slot through more than about half the thickness of the workpiece.

**Setting Up the Saw.** Now that you know the slot basics, you can set up the table saw for the job. As shown in the drawing, the blade is tilted to 45°. This way the slot will be perpendicular to the face of the miter. The blade height is set according to the slot depth.

**The Fence.** The rip fence is used to locate the slot at the same spot in each mitered face. The distance between the blade and the rip fence determines its position. The tip of the miter simply slides along the fence as you make the cut.

**Cutting Slots.** With the blade adjusted and the fence locked in position, you're ready to cut the grooves. When cutting the grooves in narrow pieces, I use the miter gauge with an auxiliary fence to feed the workpiece and back up the cut (lower photo, opposite page).

You want the slots to be perfectly aligned across the two mitered faces. The key to this is to make certain the workpiece is flat on the saw table and the tip of the miter stays in contact with the rip fence.

**Wide Panels.** When cutting a spline slot in a wide plywood or solid-wood panel, the rip fence is the only guide you'll need. You simply slide the long, mitered tip of the workpiece along the fence as you would for a rip cut. But as you can see in the photo at right, I also clamp a hold-down to the fence. The hold-down ensures that the workpiece lies flat on the saw table.

## THE SPLINES

Once the slots have been cut in all the mitered faces, you'll need to make splines to fit them. And there are a couple things to consider.

First, you want the splines to fit snugly in the slots but still slide easily into place. Remember that adding glue to the joint will tighten up the fit. Second, the splines should have the strength needed for a solid assembly. There are several ways to reach this goal (right margin photo).

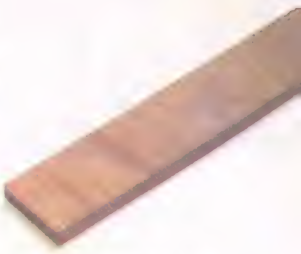
**Spline Options.** For narrower, hardwood assemblies, like the one in the main photo on the opposite page, I use solid-wood "crossgrain" splines. The box below explains why and how.

When assembling wide plywood or solid-wood panels, I take a different approach. Here I'll simply cut my splines from a piece of ⅛" plywood or hardboard. This gives you a strong spline with a fit that's ready-made for a ⅛" saw kerf.

In plywood, the edges are generally covered and the ends of spline are hidden. For a long miter in solid wood when the spline will show, I use a different approach. Here, a plywood spline can be cut to fit short of the slot ends. Then hardwood caps are added to create the look of a hardwood spline.

All in all, you can see it's a pretty simple technique. But it's one that yields big benefits for the effort.

***Wide Panel.*** *To keep wide panels flat on the saw table, I use a simple hold-down that relies on a ⅛" plywood "spring" for pressure.*



▲ ***Solid-wood.*** *For miter joints in narrow, solid-wood pieces, use a crossgrain spline.*

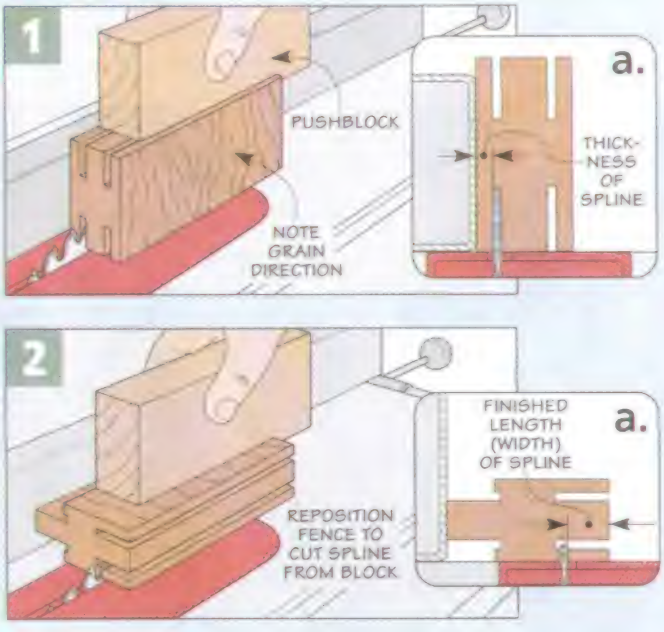
▲ ***Long Miters.*** *A "capped" plywood (upper) or a hardboard (lower) spline work well for long miter joints.*

# Making Crossgrain Splines

The easiest way to make a hardwood spline is to simply rip a thin strip from a board. But now imagine putting a lot of stress on a miter joint assembled with a thin, long-grain spline. The spline would likely split along the grain and the joint would come apart.

The best way to make a hardwood spline is shown in the drawings at right. This technique for cutting crossgrain splines from a short scrap is just a little more involved but the result has a couple of big advantages.

Since the grain of the spline is running across the joint, there's no chance of the spline splitting and the joint failing. A second benefit is appearance. As you can see in the inset photo on the opposite page, the exposed end of the crossgrain spline matches the grain of the mitered pieces.



See why you'll want these specialty tools in your toolbox.

## our top choices

# Mallets & Hammers

I'm as guilty as the next guy. When I need a hammer or mallet in the shop, I usually reach for my trusty, old 16-oz. claw hammer. But it's not really suited for a lot of woodshop tasks like driving a small nail or knocking together a joint without marring the workpiece.

So I decided to take a look at some other hammers and mallets that are more suited to the work I do in my shop. They're inexpensive, but come in handy for a lot of tasks like chiseling out a mortise or driving a brad into a picture frame.

### HAMMERS

When it comes to driving a small brad or finish nail, it's always a trick to get it started because my fingers are in the way. But I've found a couple of unique hammers that are designed to make this task easier — and less painful.

**Warrington.** Take a look at the photo above, for example. The Warrington-style hammer has a conventional, round end like most hammers. But the other end is a "cross pein" that's nothing more than a narrow, flat head for driving small nails or brads. This allows you to hold the brad to start it without having to worry about smashing your fingers. Once you get the brad started with the narrow head, you can flip the hammer over and use the round end to drive it home.

**Picture Framing.** I like to use small brads to hold pictures in a frame. The problem is that using a hammer with a round head makes it tricky to keep the brad flat with the cardboard backing.

The hammer at the left offers a unique solution. It has a round head, but the other end is triangle-shaped. And this triangular head spins 360° like a pinwheel.

▼ *Specialty Hammers. These two hammers drive small nails with ease. And without the worry of injured fingers.*

▲ *In a Tight Spot. The triangular face of this hammer swivels to make it easy to drive into a corner.*

▲ *Comfortable. This Journeyman's mallet just feels good in your hand. The solid brass head and smooth handle make it easy to hold in a variety of positions for fine work.*

Because the head swivels, you can hold the handle at any angle and one side of the head will always sit flat on the surface, allowing you to drive a fastener right into a tight corner.

## MALLETS

I've used an old rubber mallet in my shop for a lot of years. But it's not something I would use on my chisels. And it's not always the best tool for knocking together joinery. It "bounces" too much and often will mar the surface of the project.

I've found a couple of special mallets that are ideal for these tasks and all-around shop use.

**Brass.** For light chisel work like a hinge mortise, I really like the brass-head mallet shown in the photos above. The solid brass head gives it enough weight and heft to do the job. And the rounded hardwood handle has a smooth shape that's comfortable. This mallet is small enough to fit nicely in my hand without feeling unbalanced or too heavy.

The handle and brass head are shaped in such a way that allow me to hold the mallet in a variety of positions as you can see above. And when I need a little extra persuasion, I can hold the handle in my fist like a traditional mallet.

**Brass and Wood.** I found a mallet that will probably force my rubber mallet into retirement. It's *Lee Valley's* wood-faced *Cabinetmaker's Mallet* shown in the two photos at right. It has a uniquely shaped, cast brass head that provides a significant amount of weight. And the replaceable faces of end-grain hardwood are gentle on my tools and projects.

◀ *Brass Mallet. The small size and heft of the brass head make a great combination. You'll want to keep this mallet in easy reach.*

If you look closely at the inset photo shown at the upper right, you can see that the faces of the mallet are slightly angled. This is designed take into account your wrist action as you use the mallet so that the faces strike squarely on the worksurface.

**Availability.** For about $10 to $30 each, you can add these unique hammers and mallets to your toolbox (see Sources on page 51). That's only a modest investment and you'll appreciate having the right tool for the job.

▲ *Wood-faced Mallet. The cast brass head provides enough heft and the wood faces won't damage your work or tools.*

# Handy: Pocket Hammer

While my framing hammer is usually too big to use in the shop, a claw hammer still comes in handy. That's why this "pocket hammer" from *Lee Valley* has earned a spot in my shop apron pocket.

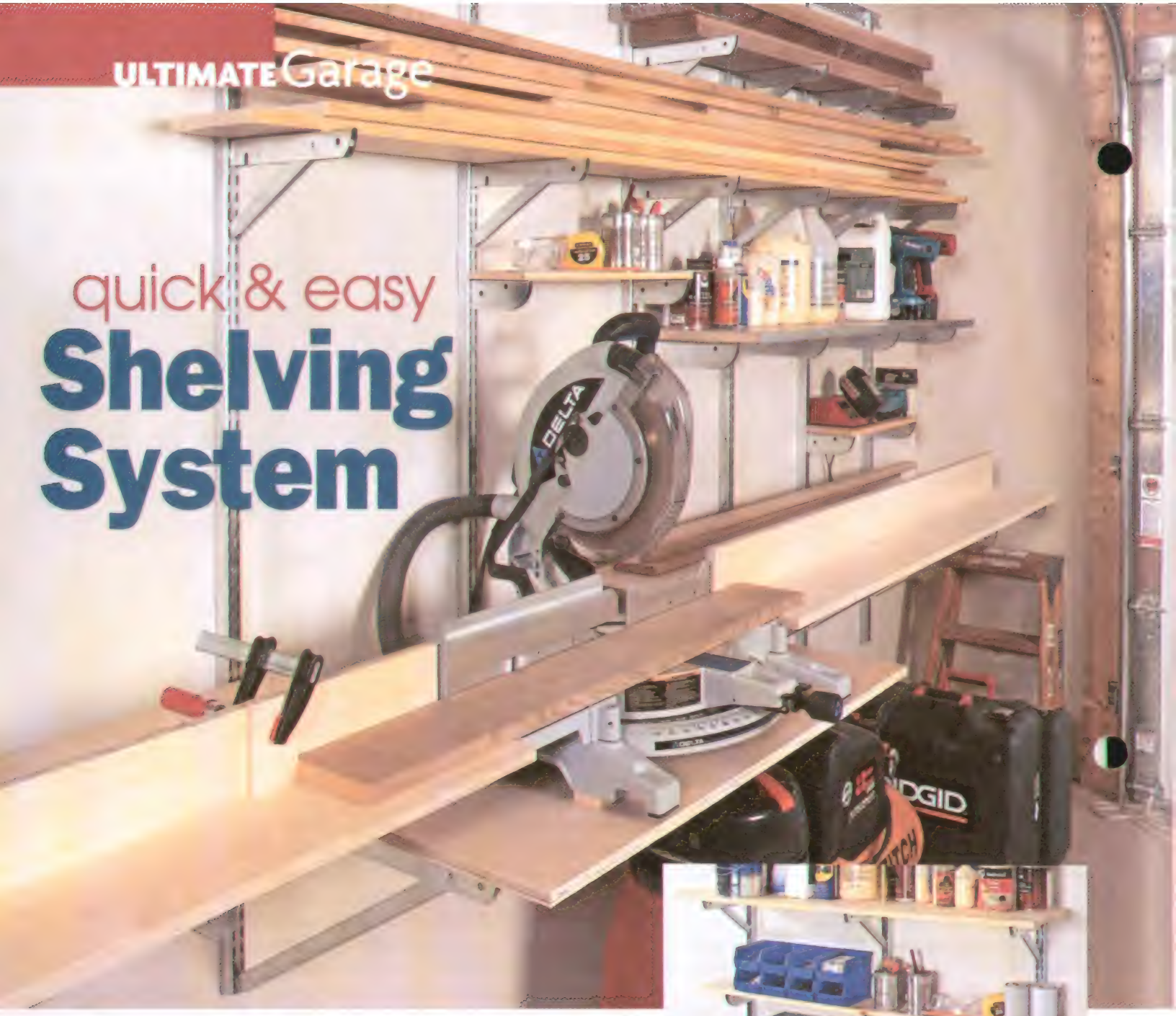
When I first saw the hammer, I thought it would be a little "top heavy" in my hand. But the small, 5-oz. head and the 7"-long shaped handle give it a good feel. The handle is fatter at the end which makes using it more comfortable.

I find myself using it a lot whenever I assemble cabinets and furniture projects. It's small size makes it handy in my pocket and easier to drive finish nails and larger brads in tight spots. And as much as I hate to admit it, the claw end comes in handy for that occasional bent nail.

***Pocket Hammer.** The smaller head and shorter handle make it ideal for shop or household use.*

quick & easy

# Shelving System




## Customize the storage in your garage shop with this heavy-duty shelving system.

Organizing your garage or shop can seem like an overwhelming task. But I found some inexpensive shelving components at my local home center that can make flexible and sturdy wall-mounted worksurfaces and storage areas quickly and without a lot of effort.

The *Fast-Mount* shelving system from the *John Sterling Corporation* fits the bill. It's a heavy-duty shelving system you can use in your garage or shop. With just a few components and a little planning, you can have your shop organized in no time.

▲ ***Sturdy Worksurface.*** *Using the heavy-duty supported brackets, you can quickly set up a handy workbench. And you can remove it at any time.*

The first thing you'll need to do is decide where to install the shelving components. The *Fast-Mount* system consists of shelf brackets and double-slotted wall standards (the manufacturer calls them "uprights").

**Uprights.** The uprights come in three lengths — 2', 4', and 6'. To fasten the uprights securely to your wall, there are four different methods you can use (see the box on the right). These mounting options will handle just about any shop wall configuration you have.

**The Layout.** Once you have the uprights properly secured to the wall, you can begin laying out how you want to organize the shelving. The brackets you choose will depend on two things — the depth of the shelf you want and how much weight it will hold.

**Shelf Brackets.** For shop applications, you'll want to use the heavy-duty brackets shown in the photo below. The double brackets come in 5", 10", and 14" lengths. They'll hold up to 150 lbs. each. The supported brackets also come in three sizes — 10", 13", and 20" and hold up to 300 lbs. each.

The supported brackets have a brace that connects to the upright as shown in the photos below and on the previous page. I've found that this makes them plenty strong for most shop needs.

It's not likely you'll overload these brackets, but to be safe, you'll want to make sure to read the labels for the load rating.

**Miter Station.** As you can see in the photos on the opposite page, you can take advantage of the supported brackets (with the brace) to create a miter station.

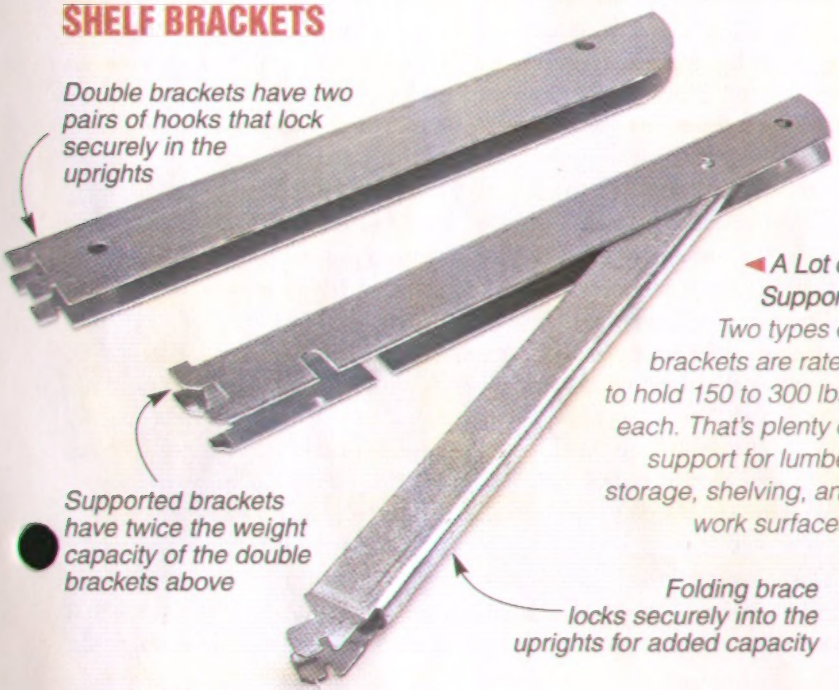
Once you find a comfortable working height for the saw, you can install the supports and screw the worksurface in place. Then use the double supports for mounting the extension wings. I placed shims under the miter saw to make the wings flush with the saw table.

**Versatile Storage.** For lumber storage, these shelf brackets work great. What's even better is that you don't need to bother installing a shelf since you can lay your lumber right on the brackets.

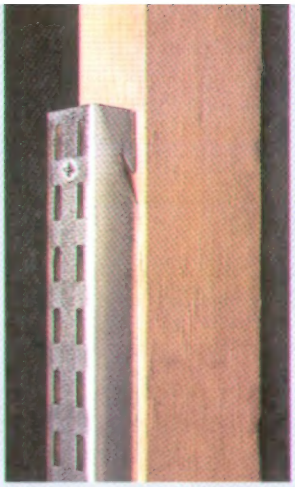
To keep my supplies organized and handy, I used the smaller double brackets for shelving.

**Availability.** As I mentioned before, I found most of the components for this shelving system at my local home center. But you can order them from other sources you'll find listed on page 51. Prices may vary, so you'll want to shop around to get the best deal.

## SHELF BRACKETS




**A Lot of Support.** *Two types of brackets are rated to hold 150 to 300 lbs. each. That's plenty of support for lumber storage, shelving, and work surfaces.*



**Screw Mount.** *You can mount the uprights directly to studs or block walls using screws.*

**Hook.** *If your ceiling is unfinished, you can hang the uprights from the top plate using the hooks.*

# Mounting Options

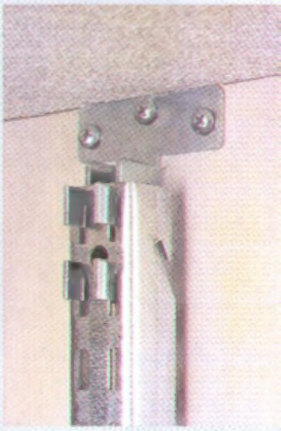
One of the best things the *Fast-Mount* system has going for it is that it mounts to your wall a number of different ways.

The simplest option is to screw the uprights directly to the wall or studs (top left photo). You'll want to be sure to screw them directly into the studs or use appropriate wall anchors to make them secure.

If you have block or concrete walls, you can use the *Fast-Mount* hook as shown in the top right photo above. It rests directly on top of the wall plate or block or concrete wall.

Another option is the *Fast-Mount* mounting bracket. It's a T-shaped piece of metal that screws into the top plate or wall stud (see middle photo at right). The upright hangs on the four hooks for a secure connection.

The most versatile mounting method is the *Fast-Mount Hang-Track* you see in the photo at right. You can mount it to the top wall plate, studs, or block wall. The uprights have a slot on the back side at the top that fits over the raised lip on the *Hang-Track*. This allows you to slide the upright and position it right where you need it.



**T-Bracket.** *The T-bracket screws securely into a stud or along the top plate of your wall.*

**Hang-Track.** *You can space uprights anywhere along the track for maximum versatility.*

Q&A

**questions from**
Our Readers

# mail order Lumber

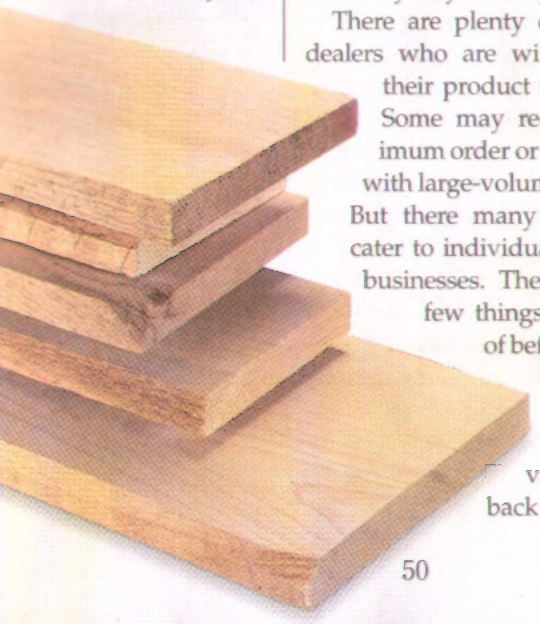
*I live in a rural area and the only place I can buy lumber doesn't have much of a selection (just oak and pine). I've seen ads in woodworking magazines for hardwood lumber dealers that sell wood through the mail, but I'm a little hesitant to try this. What do you think?*

*Dave Ritchie*
*via email*

***Delivered to Your Door.*** *If you don't have a lumber dealer nearby, ordering wood by mail can be a convenient option.*

Lumber selection can vary greatly depending on what part of the country you live in and how close you are to a large population center. Most home centers have a pretty limited selection of lumber for building furniture projects.

And even if you're fortunate enough to have a hardwood lumber dealer nearby, you may be looking for an unusual species of wood that your local dealer doesn't carry. If so, ordering lumber by mail may be your only option.



***Inside.*** *Once you remove the cardboard and plastic wrapping, the wood looks like it just left a lumberyard.*

There are plenty of hardwood dealers who are willing to ship their product to your door. Some may require a minimum order or prefer to deal with large-volume customers. But there many dealers that cater to individuals and small businesses. There are just a few things to be aware of before you place an order.

Of course, the most obvious drawback to ordering lumber through the mail is that you're buying it sight unseen. In this sense, you're at the mercy of the dealer. But you can improve the odds of getting what you want by asking as many questions as possible up front.

Is the lumber graded, and if so, what grade are you buying? Are the boards surface planed or roughsawn? How is the lumber dried (air-dried or kiln-dried)? What lengths and widths are available? The idea is to get an accurate mental picture of the wood you are buying *before* you actually place your order.

**Choosing a Dealer.** Of course, finding a dealer that you feel comfortable with is kind of like finding a mechanic. You may have to try two or three before you come across one that you feel comfortable with and that's willing to work with you.

One way to find a reliable lumber dealer is to place a small order first and see if you're happy with the lumber and the service. And I've found that once you establish a relationship with a dealer, you're more likely to get "special" treatment the next time you place an order. (I've had good experiences with *Badger Hardwoods*, see margin on opposite page.)

**Shipping.** The biggest drawback to buying lumber through the mail is the added cost of shipping. (I spent $85 on shipping for an order of 60 bd. ft. of lumber.) Make sure you discuss the shipping costs at the time you place your order so there won't be any surprises.

It's also a good idea to ask how your order will be packaged and shipped. My order was wrapped in cardboard and arrived in good condition (see photo above).

**WoodFinder.** Here's one final tip. If you're looking for a specific species of wood, there's a website (*www.woodfinder.com*) with a program that can help you find it. All you do is type in the species of wood you want and it will give you a list of dealers who stock that species and are willing to ship.

# Sources

## THICKNESS SANDER

You'll find much of the basic hardware needed to build the thickness sander on page 28 at your local hardware store or home improvement center. But some items, like the steel shafts and pulleys, might be a little more challenging to find.

The ½" steel shaft (8920K15), ¾" shaft (1346K32), bronze sleeve bearings (6391K212), 5" x ⅝" 4L belt pulley (6245K47), 2" x ⅝" 4L belt pulley (6245K16), and 4L440 V-Belt (6191K37) were all ordered from *McMaster-Carr*. I was able to get the handle for the conveyor (6473K77) and the ⅜" studded knobs (5993K43) from there as well.

The two pillow blocks (PRB-156) were ordered from *Reid Tools*. And the ⅜" through knobs (23820), as well as the magnetic catch (29280), came from *Rockler*.

You'll also need sandpaper for the conveyor and the drum. I used a 16" x 48" 100-grit sanding belt (WB51410) for the conveyor belt. Rolls of sandpaper to wrap the drum roller come in a variety of grits. I got these from *Klingspor*.

I picked up a piece of 1/16"-thick polycarbonate at a local plastics dealer to make the cover for the dust hood. You can also find it available from suppliers of plastic listed in the right margin.

## SUPPORT STANDS

A support stand like those featured on page 40 can be a big help when working with longer materials. I was able to pick up the flat-top roller stand made by *Ridgid* (AC9933) at *Home Depot*.

The *Ultimate Roller Stand* (50U01.01) and the roller bearing stand (17U12.01) were ordered from *Lee Valley*. And the heavy-duty *Flip Top Roller Stand* (43399) and the roller support with universal clamp (64194) came from *Rockler*. The last two support stands are also available at the *Woodsmith Store*.

## JIG SAW BLADES

The straight-tooth jig saw blade (12520-5) featured in the article on page 26 is made by *Porter-Cable*. Other good quality blades can also be found at most hardware stores and home centers.

## PLASTICS IN THE SHOP

Small plastic sheets can be found at many home improvement and hardware retailers. If you need larger acrylic and polycarbonate sheets, you'll probably need to order them. The sheets used in the article on page 10 were ordered from *Regal Plastics* and *United States Plastic Corp.* You can find contact information in the right margin.

## MALLETS & HAMMERS

Having the right hammer for the job can really make working in the shop a lot easier. The picture framing hammer (05K9923), *Cabinetmaker's Mallet* (05E1501), *Veritas Journeyman's Brass Mallet* (05E1401), and *Pocket Hammer* (50K3701) I used in the article on page 46 are all available from *Lee Valley*. The *Warrington* pattern hammer is available at many woodworking and retail stores as well as from *Lee Valley*.

## FAST-MOUNT SHELVES

Quick and inexpensive shelves like those on page 48 are a great addition to any garage or shop. I was able to find the *Fast-Mount Shelving* at a local home center. You can also order this shelf system from *Lee Valley* and *Garrett Wade*.

## BRAZING BAND SAW BLADES

If you want to repair band saw blades using the brazing technique featured on page 12, you'll need to find a blade brazing kit. These kits are available from a number of sources. The blade brazing kit I used came from *Woodworker's Supply* (897450).

## MAIL ORDER SOURCES

**Woodsmith Store**
**woodsmithstore.com**
**800-444-7527**
*Support Stands*

**Rockler**
**800-279-4441**
**rockler.com**
*Fluorescent Glue, Magnetic Door Catches, Star Knobs, Support Stands*

**Ridgid**
**800-474-3443**
**ridgid.com**
*Support Stands*

**McMaster-Carr**
**562-463-4277**
**mcmaster.com**
*Bronze Bearings, Belt Pulleys, Knobs, Plastics, Steel Shafts, V-Belts*

**Lee Valley**
**800-871-8158**
**leevalley.com**
*Blade Brazing Kit, Fast-Mount Shelving, Gap-Filling Glue, Hammers & Mallets, Support Stands*

**Garrett Wade**
**800-221-2942**
**garrettwade.com**
*Fast-Mount Shelving*

**Reid Tools**
**800-253-0421**
**reidtool.com**
*Knobs, Pillow Blocks*

**Porter-Cable**
**800-487-8665**
**porter-cable.com**
*Jig Saw Blades*

**U. S. Plastic Corp.**
**800-809-4217**
**usplastic.com**
*Plastics*

**Regal Plastics**
**800-867-8347**
*Plastics*

**Klingspor**
**800-228-0000**
**woodworkingshop.com**
*Sanding Rolls & Belts, Brass Mallets*

**Woodworker's Supply**
**800-645-9292**
**woodworker.com**
*Blade Brazing Kit*

**Badger Hardwoods of Wisconsin**
**800-252-2373**
**badgerwood.com**
*Mail Order Lumber*

**McFeely's**
**800-443-7937**
**mcfeelys.com**
*Specialty Screws*


## ShopNotes Binders

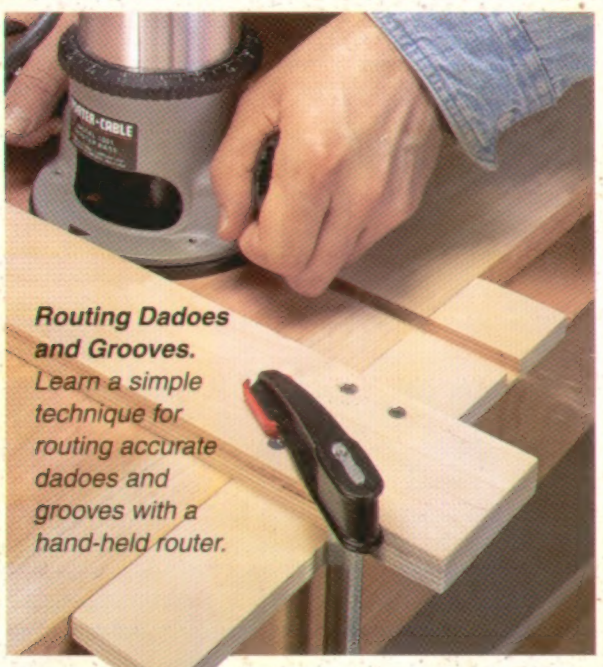
**Keep your issues organized!**

As you build your *ShopNotes* library, here's a way to keep your issues organized. Each binder features durable vinyl covers and easy-to-read perforated number tags. Snap rings with a quick-open lever make it easy to insert and remove issues. And there's an extra pocket inside for storing notes. Each binder holds a full year (6 issues) of the new, expanded *ShopNotes*.

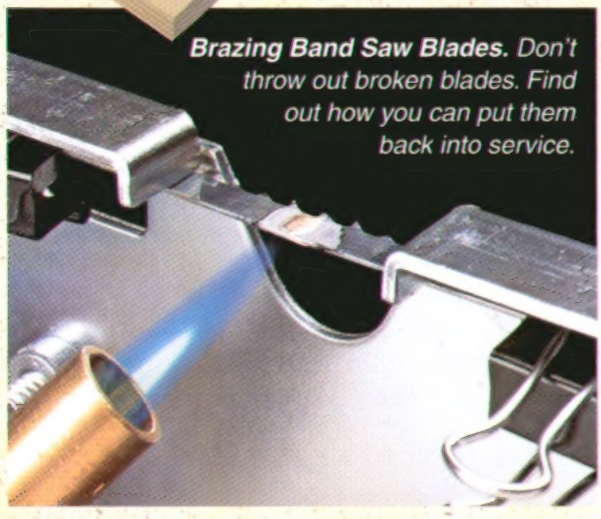
Visit **www.ShopNotes.com** to order these binders, or call **1-800-444-7527**.

***ShopNotes* Binder**
❍ **701950-SN86** (*Holds 6 issues*).....$12.95

# Scenes from the Shop



**Routing Dadoes and Grooves.** *Learn a simple technique for routing accurate dadoes and grooves with a hand-held router.*



**Brazing Band Saw Blades.** *Don't throw out broken blades. Find out how you can put them back into service.*

▼ **Router Bit Storage System.** *Tame your router bit collection with this easy-to-build cabinet. It features tilt-out, adjustable trays that are a snap to customize. An acrylic panel door keeps out the dust.*

**Center Finder.** *This no-measure tool makes finding the center of any workpiece as easy as 1-2-3. Best of all, you can build it in a day.*